U.S. Fish & Wildlife Service

# Hopper Mountain National Wildlife Refuge Complex


# California Condor Recovery Program 2019 Annual Report

On the Cover: California condors #654 and #20 across the sky.
Bitter Creek National Wildlife Refuge, Kern County, California.
Photo credit: Stephanie Herrera

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*We would also like to acknowledge hunters and ranchers using non-lead ammunition for their help keeping condors and other wildlife safe from the perils of lead poisoning.*

# Disclaimer

*All products or brands mentioned in this reports are to inform readers of the methods and equipment used and are not an endorsement of these products of brands.*

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# Executive Summary

The Hopper Mountain National Wildlife Refuge Complex (Complex) manages a reintroduced California condor population in Southern California. The Bitter Creek and Hopper Mountain National Wildlife Refuges are used as the primary management locations for the release, monitoring, and recapture of condors in this region. Blue Ridge National Wildlife Refuge is a third refuge in the complex that provided roosting habitat for condors but no field activities occur on this refuge at this time.

As of December 31, 2019, the California condor population managed directly by the Complex consisted of 99 free-flying condors. The population produced three confirmed wild chicks fledged from seven nests in 2019, and a possible additional fledge chick from one nest with an unknown fate. Three of these nests were remotely monitored using nest cameras. Twelve captive-reared juvenile condors were released at Bitter Creek National Wildlife Refuge in 2019, along with one adult that had previously been released in Southern California in 1995 and was recaptured in 2008. One of the juvenile new releases failed to thrive, and was brought back into captivity shortly after release. As a result of the successful wild nests and captive releases, the population increased by 8.79%.

The condor population in Southern California continues to recolonize its former range, exemplified by new nest territories established in the Tehachapi backcountry, as well as the southern Sierra Nevada foothills. The range of condor activity continues to expand and move north, and includes Blue Ridge National Wildlife Refuge. Condors continued to occupy the northern Tehachapi Mountains where they occasionally interact with humans and associated attractions in the residential mountain communities of Bear Valley Springs, Stallion Springs, and Alpine Forest Park. Condor activity within the footprint of wind energy facilities near the Tehachapi Mountains decreased slightly from 2018.

The field team attempted to trap condors during two trapping periods to replace transmitters and monitor for lead exposure that occurs when condors ingest carrion or gut piles that have been shot with lead ammunition. Trapping has become more difficult as the population's range has expanded and individuals have become less reliant on proffered food sources. In 2019, 15 condors (16% of the population) evaded trapping. Lead exposures continue to occur in the population, with 24% of the lead tests performed resulting in blood lead levels greater than 35 μg/dL.

A total of 4 condors were declared dead in 2019. One of those condors went missing in the wild in 2018 and was declared dead after being missing for 365 days, two died while receiving medical treatment after being captured in the wild and transferred to the Los Angeles Zoo, and the carcass of one free-flying condor was recovered on private property. Two of the condors were determined to have died of lead toxicosis, and one died of aspergillosis.

The Complex used partnerships to increase the level of condor education and outreach. The Complex, in partnership with the Santa Barbara Zoo, continued showcasing condor nesting behavior and management on the Condor Cave Facebook page (https://www.facebook.com/TheCondorCave/). The Condor Cave has increased its following by 1.55% with a total of 15,292 followers as of December 31, 2019. A condor nest camera was again streamed live on the internet through a partnership with the Cornell Lab of Ornithology, Santa Barbara Zoo, and Western Foundation of Vertebrate Zoology. While streaming, it was viewed approximately 400,000 times, from 72 countries, for a total of 2.2 million minutes (4 years and 2 months). The CondorKids program also continued in 2019 at the Fillmore Unified School District with all 12 third grade classes, 300 students, participating. The program expanded to include a seventh grade curriculum, with 150 students participating. The Institute for Wildlife Studies non-lead outreach coordinator conducted 66 outreach activities reaching 3,455 people. Other condor related outreach activities included tours of the wildlife refuges; educational booths; presentations to interest groups, elementary, high school, and college students; and interviews with local news media, a podcast, a documentary crew, and USFWS public affairs staff.

# Southern California Population Highlights

## Population Size

(as of December 31, 2019)

| | Adults (≥6 years old) | Juveniles (<6 years old) | Total |
|---|---|---|---|
| Males | 23 | 33 | 56 |
| Females | 23 | 20 | 43 |
| Total | 46 | 53 | 99 |

For more information on the change in population size see Figure 3.5.1

## Nesting

| | Successful Nests | Failed Nests | Total |
|---|---|---|---|
| Nests in 2019 | 3 | 3 | 7* |
| All Nests since 2001 | 47 | 53 | 101 |

For more information on annual nesting success see Figure 3.4.1

* One nest is remote and success of the nest is pending; GPS data suggests chick survived and fledged but has not yet been confirmed in the field.

## Captive Releases

| | Number of Condors |
|---|---|
| Releases in 2019 | 13* |
| Total Number of Releases since 1992 | 176 |

For more information on the 2019 captive releases see Table 3.5.1

*One condor re-captured shortly after release in 2019 and brought back to captivity

## Condor Deaths

| | Number of Condors |
|---|---|
| Deaths reported in 2019 | 4 |
| Total Number of Deaths since 1992 | 135 |

For more information on the condor deaths in 2019 see Table 3.3.1

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# 1.0 Introduction

The California condor (*Gymnogyps californianus*) is a federally listed endangered species. The current recovery priority ranking for the California condor is 4C. The "4" designation indicates that the California condor is a monotypic genus that faces a high degree of threat and has a low potential for recovery.The "C" indicates conflict with construction, development projects, or other forms of economic activity.

California condors are among the largest flying birds in the world, with a wingspan measuring up to 2.9 meters (9.5 feet; Photo 1.0.1). Condors are a long-lived species with an estimated lifespan of 60 years. They are slow to mature, and typically begin to reproduce at six years of age. Condors often form long-term pairs and fledge one chick every other year. If a nestling fledges relatively early (in late summer or early fall), its parents may nest again the following year (Snyder and Hamber 1985).

California condor habitat can be categorized into nesting, foraging, and roosting components (USFWS 1975). Condors forage in the open terrain of foothill grassland, oak savanna, woodland habitats, and on the beaches of steep mountainous coastal areas. Condors maintain wide-ranging foraging patterns throughout the year, which is an important adaptation for a species that may be subjected to an unpredictable food supply (Meretsky and Snyder 1992).

**Photo 1.0.1**: California condor #636 flies over the Bitter Creek NWR, Kern County, California. *Photo credit: Jessy Wilson, Great Basin Institute*

Condors feed on the carrion of mule deer (*Odocoileus hemionus*), tule elk (*Cervus canadensis nannodes*), pronghorn antelope (*Antilocapra americana*), feral hogs (*Sus scrofa*), domestic ungulates, and smaller mammals such as ground squirrels. Their diet also includes the carrion of whales, sea lions, and other marine species if foraging along the coast (Koford 1953; USFWS 1984; Emslie 1987; Burnett et al., 2013).

California condors are primarily a cavity nesting species, typically choosing cavities located on steep rock formations or the burned out hollows of old growth conifers such as coastal redwood (*Sequoia sempervirens*) and giant sequoia trees (*Sequoiadendron giganteum*) (Koford 1953; Snyder et al., 1986). Less typical nest sites include cliff ledges, cupped broken tops of old growth conifers, and in several instances, nests of other species (Snyder et al., 1986; USFWS 1996). Condors repeatedly use roosting sites on ridgelines, rocky outcrops, steep canyons, and in tall trees

or snags near foraging grounds or nest sites (USFWS 1984).

The U.S. Fish & Wildlife Service (Service; USFWS) Hopper Mountain National Wildlife Refuge Complex (Complex) serves as the lead office for the California Condor Recovery Program (Recovery Program) that originated in 1980 and is one of many partners that support this multi-state and international recovery effort. The Complex has participated in the California condor reintroduction effort since 1992 when the Complex was established and took over the Program from the Patuxent Wildlife Research Center. In Southern California, the Service operated a number of different release sites both on refuges and U.S. Forest Service lands and has annually released condors produced from captive breeding facilities. Over time, these releases led to the establishment of the Southern California condor population, the group of condors directly managed by the Complex's Condor Field Team (field team).

Over the last 27 years, the field team has been responsible for the continued monitoring and management of the reintroduced population, working both on and off refuge. Today, two of the wildlife refuges in the Complex, Bitter Creek National Wildlife Refuge (Bitter Creek NWR) and Hopper Mountain National Wildlife Refuge (Hopper Mountain NWR) (Photo 1.0.2), are the primary management locations for the Southern California condor population—which currently inhabits portions of Monterey, San Luis Obispo, Santa Barbara, Ventura, Los Angeles, Kern, Tulare, Fresno, Madera, Mariposa, and Inyo Counties (Figure 1.0.1). The California Condor Recovery Plan (Recovery Plan) provides the overarching guidance for recovery strategies and field activities.

Photo 1.0.2: View of Hopper Mountain NWR, Ventura County, California. *Photo credit: Molly Astell, USFWS*

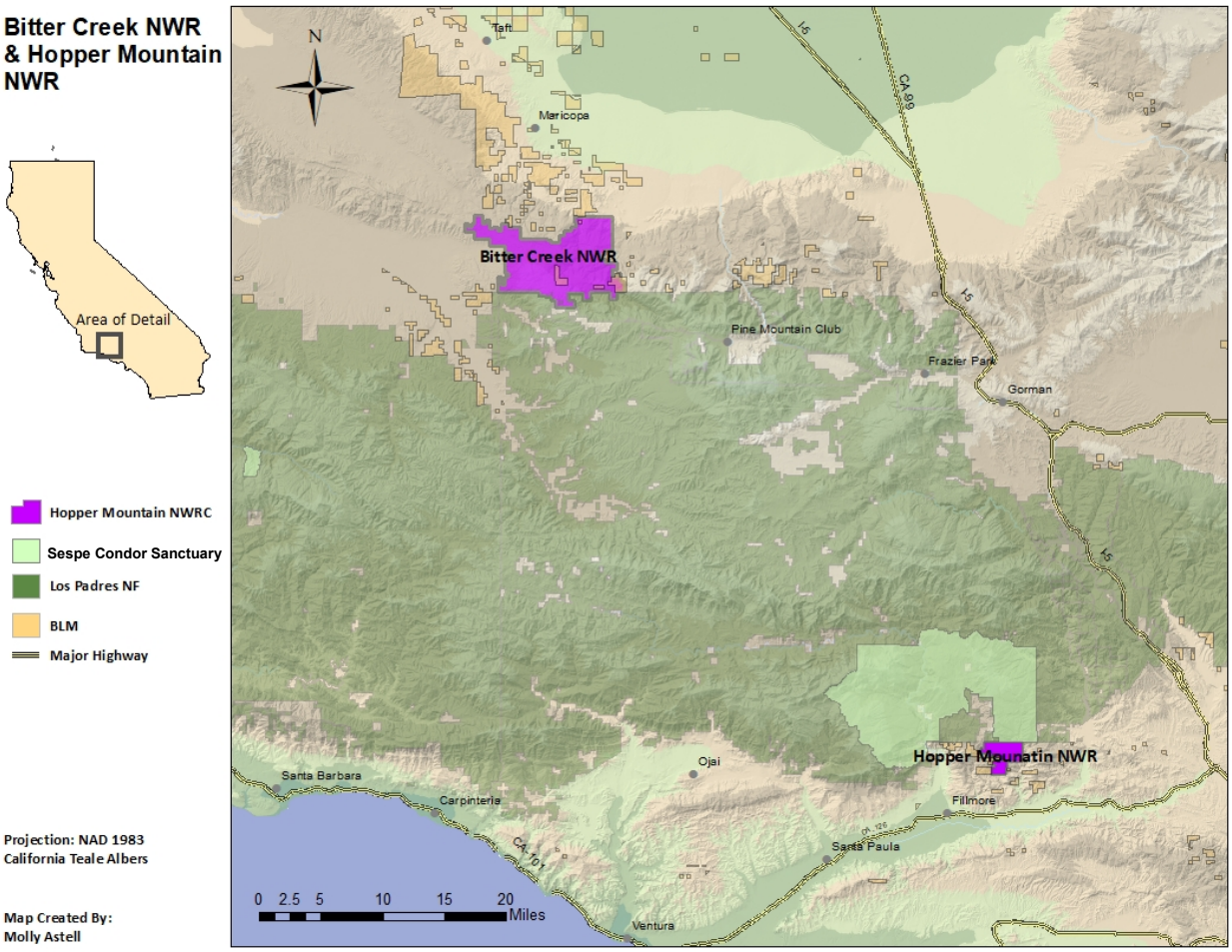



**Figure 1.0.1**: Hopper Mountain NWR and Bitter Creek NWR are the primary locations for California condor management conducted by the field team.

The primary objective driving the reintroduction effort is to establish one of at least two wild, self-sustaining populations of 150 individuals with 15 breeding pairs (USFWS 1996). The Recovery Plan consists of five key actions: 1) establish a captive breeding program, 2) reintroduce California condors into the wild, 3) minimize mortality factors, 4) maintain condor habitat, and 5) implement condor information and educational programs (USFWS 1984). In accordance with the Recovery Plan, "Released California condors should be closely monitored by visual observation and electronic telemetry" (USFWS 1984).

The main focus of the efforts of the field team are in implementing the second, third, and fifth key actions of the Recovery Plan. To support the second key action, the field team manages a condor release site at Bitter Creek NWR. To support the third key action, the field team monitors the free-flying population of condors to identify threats and reduce adverse effects to condors, which includes minimizing mortality factors. Both refuges provide facilities designated for trapping and holding condors which allows condors to be handled for attaching tags and transmitters, and performing routine

health checks. Also in accordance with the Recovery Plan: "Condor blood, feathers, eggshells, and other tissues will be collected opportunistically and analyzed for heavy metals, pesticides, and other potential contaminants." (USFWS 1984). To support the fifth key action, the field team conducts outreach to educate the public in an effort to support recovery of the species.

The field team is comprised of a number of different members including Service employees, partner employees, interns and volunteers. In 2019, the Service employed one full-time permanent supervisory wildlife biologist, three full-time permanent wildlife biologists, and a Biological Science Technician. The Complex also employed one park ranger who assisted with the CondorKids program, a major education and outreach project funded by the Service's Urban Refuge Initiative, and coordinated activities with the Friends of California Condors Wild and Free (FCCWF).

The Santa Barbara Zoo has been an essential partner for the field team. Since 2007, the zoo has assisted with nest management and research in the Southern California condor population with one full-time permanent condor biologist, a condor nest biologist and nest technician that filled in during a period of staffing vacancy, and a conservation and science associate.

In addition to the various Service and Santa Barbara Zoo positions, the field team has four biological intern positions that are filled throughout the year. These positions are funded by the Service through a cooperative agreement with the Great Basin Institute. Great Basin Institute interns commit to working 40 hours a week for a period of six months for a daily stipend. These positions are also AmeriCorps volunteers and are eligible to receive an educational award dependent upon completion of 900 hours worked.

Field activities are also supported by volunteers or other program partners. Volunteers primarily assist with monitoring nests during the ten month nesting season, but also assist with condor monitoring via radio telemetry and trapping efforts on a more limited basis.

A variety of support also comes from other program partners. The Los Angeles Zoo provided assistance in caring for sick and injured condors, and helped during handling events and nest entries. The FCCWF helped with outreach events and maintenance projects. The Cornell Lab of Ornithology and the Western Foundation of Vertebrate Zoology assisted with live streaming a condor nest camera online. The Institute for Wildlife Studies (IWS) conducted a variety of non-lead outreach activities in coordination with the field team. Lastly, several universities collaborated on condor research relevant to conservation needs.

## 1.1 Funding

In 2019, the Complex received $728,028 in U.S. Fish and Wildlife Service Recovery funds (1113). The Complex used these resources to fund the field team and their activities as well as a condor coordinator position and office space costs. Refuge management funds (126x) also contributed significantly to condor related equipment, activities, and administration costs.

In addition to Service funds, various non-government funds contributed to condor recovery activities at the Complex. The Santa Barbara Zoo's Department of Conservation and Science and Condor Survival Fund at the Santa Barbara Museum of Natural History also made significant contributions (Photo 1.1.1).

One of the funding and operational challenges that the program faced in 2019 was a government shutdown that occurred due to a lapse in federal appropriations. All activities, except those deemed essential, were suspended. This began on December 21, 2018 and lasted 34 days.

**Photo 1.1.1**: A biologist with the USFWS field team sets up equipment, provided by the Santa Barbara Zoo, for a 2019 nest camera. Ventura County, California. *Photo credit: Molly Astell, USFWS*

# 2.0 Primary Operations

The field team based within the Complex office in Ventura, California performs seven primary operations with the goal of achieving a self-sustaining population of condors in California (Figure 2.0.1). The primary operations performed are: Monitoring Resource Use, Lead Monitoring and Mitigation, Detecting Mortalities, Nest Management, Behavioral Modification, Captive Releases & Transfers, and Outreach. These primary operations are meant to assist in the recovery of the species and address the major threats condors face in the wild.

## 2.1 Monitoring and Resource Use

The loss and modification of California condor foraging, roosting, and nesting habitat is recognized as a historic threat to the recovery of the species. As noted in the 1979 Recovery Plan (USFWS 1979), adequate nest sites, roost sites, and foraging habitat with adequate food are the basic habitat needs of the condor. The 1996 Recovery Plan acknowledges the presence of sufficient remaining condor habitat in the Southwestern United States but notes that maintaining this habitat is a key recovery action (USFWS 1996).

The field team monitors nesting, roosting, and foraging habitat use across Southern California using data from global positioning system (GPS) transmitters attached to condors. GPS transmitter locations are used to understand condor resource use over a large geographic and temporal scale.

The goal of the field team is to equip all California condors in the Southern California population with either two very high frequency (VHF) transmitters attached to retrices (Kenward 1978), or a combination of one VHF transmitter and one patagial mounted (Wallace 1994) GPS transmitter. Some condors in the population do not have transmitters because transmitters are dropped or malfunction in between trapping sessions, or condors are not trapped for a prolonged period of time. Nestlings are typically fitted with a VHF transmitter at 4 months of age. Wild nests that are not entered may also result in untagged condors until those fledglings are trapped after they have fledged.

*Use of VHF Transmitters*

VHF transmitters allow condors to be tracked in real time. The field team uses handheld VHF receivers and Yagi antennas to locate condors by following the direction of the VHF signal in order to obtain visual observations on specific condors, such as new releases, nesting condors, or sick/injured birds. VHF transmitters are an important tool in identifying when a condor has died (see 2.3 Detecting Mortalities). The VHF transmitters used are produced by Holohil Systems Incorporated (Model # RI-2C, 10 grams).

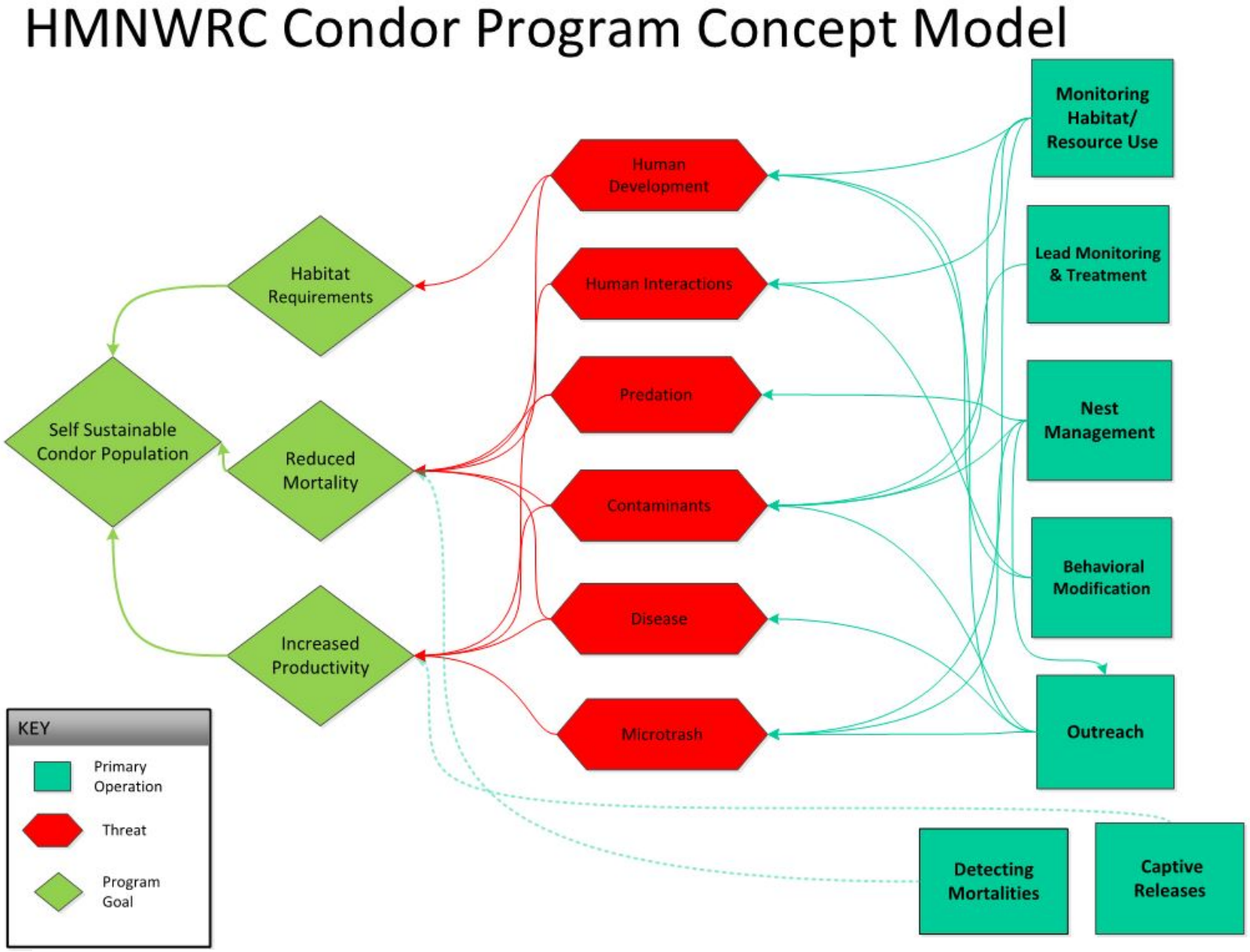



**Figure 2.0.1:** A conceptual model for the Hopper Mountain NWRC California Condor Field Program. The program's goal is to establish a wild, self-sustaining population of condors. The three program goals are limited by one or more of the seven identified threats, which are in turn addressed by the seven primary operations.

*Use of GPS Transmitters*

In 2019, GPS transmitters were produced by two manufacturers, Microwave Telemetry Incorporated (MTI) and Cellular Tracking Technologies (CTT). Both types of transmitters are solar-powered and patagially mounted. GPS Transmitters are assigned to condors as they are available and when condors without a functioning transmitter are trapped.

The Solar GSM/GPS 50g Patagial PTT transmitters produced by MTI (Photo 2.1.1) were very similar in design to the Solar ARGOS/GPS 50g Patagial PTT transmitters that were previously used on condors in Southern California (from 2005 to 2014). The MTI transmitters collect GPS locations every 2 to 15 minutes depending on peak voltage periods. The GPS location data collected by these transmitters are transmitted using cell towers via the Global System for Mobile Communications (GSM) network.

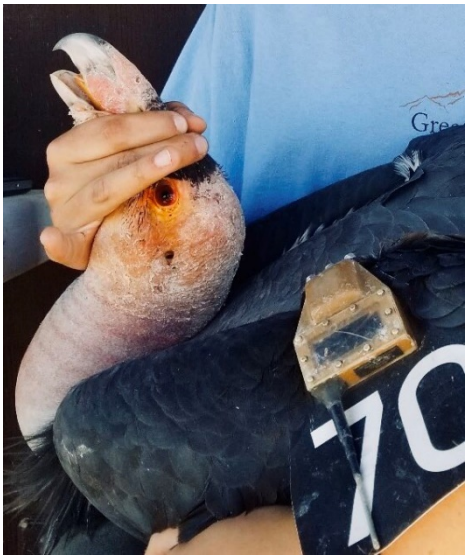


**Photo 2.1.1:** California condor #570 wearing a MTI GPS/GSM transmitter. *Photo credit: Gabe Brumagin, Great Basin Institute.*

The 50g Evolution Series 400 3G GSM transmitter was manufactured by CTT (Photo 2.1.2). These transmitters also use the GSM network to transmit the GPS locations. The CTT transmitters collect locations every 15 minutes.


**Photo 2.1.2:** A new tag and CTT GPS/GSM transmitter attached to California condor #818. *Photo credit: Halle Lambeau, Great Basin Institute*

Data generated by all transmitters is collated and distributed daily using an application (CCMAP) developed in partnership with the USGS Fort Collins Office (Waltermire et al., 2016). Once received, the field team monitors condor locations produced by the GPS transmitters on a daily basis to target locations of interest for on-the-ground investigation, an action referred to as ground-truthing. Feeding events and potential threats are prioritized for ground-truthing.

Condor GPS transmitter locations also inform program-wide objectives via long-term research projects including efforts to better understand weather conditions and condor movement (Poessel et al., 2018a), assess the impact and

distribution of lead on the landscape (Bakker et al., 2017, Poessel et al., 2018b, Kelly et al., 2014), and monitor wind energy development as a potential threat to condors. Findings from these studies may influence management strategies and policy aimed at addressing the threats to condor survival and recovery.

### 2.2 Lead Monitoring and Mitigation

Lead poisoning is a major ongoing concern for all wild California condors, including those in the Southern California population. The Ridley-Tree Condor Preservation Act (RTCPA; 2008) regulates some use of lead ammunition within the range of condors in California and may reduce the amount of lead-contaminated carrion available to scavengers throughout the condor range. California Assembly Bill 711 (AB711) expands upon RTCPA legislation to restrict the take of all wildlife with lead ammunition throughout California, but was not fully implemented until July 1, 2019. Despite these regulations, there is still potential for condors to encounter lead fragments from animal carcasses that were shot with lead ammunition (Finkelstein et al., 2012, Kelly et al., 2015). The purpose of monitoring and mitigating lead exposure in California condors is to reduce lead related mortalities and to provide guidance on management decisions and policy making.

Analysis of condor feather lead data indicate the majority of lead-poisoned birds are not prescribed chelation for lead poisoning until after their blood lead levels have already declined by about fourfold (Finkelstein et al., 2012). Typically, condor lead exposures are identified weeks after the primary exposure event has occurred and the source of the exposure (ingested lead ammunition or fragments) has been completely digested or passed (excreted or regurgitated) from the body of the bird.

The analysis also indicated that the frequency of lead exposures was much higher than previously indicated by just blood lead level data alone. If a condor only has its blood sampled during biannual trapping efforts, only about 11.5% of the annual lead exposure window would be represented (USFWS, 2017). Primary wing feather sampling represented a much larger proportion of the annual exposure window (Finkelstein et al., 2007) and indicated that on average, a condor experienced one lead exposure event surpassing past treatment thresholds every 50 days (range 0-3 events, n = 48 feathers) (Johnson et al 2013). Thus, past blood lead monitoring did not detect the vast majority of condor lead exposure events and those events went untreated.

In order to better understand the population level benefits of the 2011-2016 lead exposure treatment protocols, and as part of a larger study including condors managed by Recovery Program partners in Central California, the criteria and protocols for chelation treatment were modified in 2017. 2019 marked the third year of instituting the new lead treatment protocol, where condors were only chelated if they exhibited visible symptoms of lead poisoning. The new protocol will continue for a period of two more years, after which indicators of the condor

populations' health and lead exposure will be compared to the five years before 2017 in order to determine whether the change in treatment had a measurable effect on the population. The field team will continue to evaluate data collected under the new protocol to assess changes in lead exposure and lead-related mortality on an annual basis.

Population level survival will also be analyzed on a biennial basis using known-fate models, following a framework established by Bakker et al. (2017). This allows for a more detailed understanding of population changes due to lead poisoning mortality. A large increase in lead-related mortality without a concomitant increase in lead-exposure levels would trigger a detailed survival analysis and, potentially, a re-evaluation of the approach to managing lead exposures in the Southern California condor population.

*Trapping Condors*

Each year the field team attempts to trap and handle the entire Southern California condor population to monitor blood lead levels and, if necessary, treat condors for lead exposure. Trapping typically occurs during two periods of time, from June 1 until July 31 and then from November 1 until December 31. However, some condors are trapped at other times of the year as necessary. Some examples of this include if a condor is suspected to be sick or injured, exhibits behavioral concerns, or needs an adjustment to its transmitters. For the purposes of comparison in this report, annual trapping activities are separated into two periods: January through July and August through December.

*Blood Lead Tests*

While handling each condor, the field team collects two blood samples from the medial metatarsal vein using blood vials containing Edetate (EDTA). Per the 2017 change in protocol, a field blood lead test will not be performed when handling condors. Under the new protocols, the blood samples collected from condors are refrigerated and sent to the California Animal Health and Food Safety Laboratory System at University of California, Davis for lab analysis of lead concentrations, and the Microbiology and Environmental Toxicology Department at the University of California, Santa Cruz, for lead isotope analysis.

*Feather Sampling*

Primary wing feathers are sampled opportunistically on condors wearing GPS transmitters. Feather sampling involves first identifying that a feather is growing, measuring the growing feather, and marking that feather so it can be identified during a subsequent handling and sampled. When sampling feathers, the field team uses a standardized protocol developed by the Microbiology and Environmental Toxicology Department at the University of California, Santa Cruz. If a condor is discovered after it is deceased, an entire growing feather can be removed as a sample. All feather samples are sent to this department for lead concentration and isotopic analysis.

*Physical Exams*

Utilizing the 2017 protocol, condors are observed and examined for clinical

symptoms of lead poisoning, rather than using a field blood test result of >35 µg/dL as the threshold to send condors for treatment. The field team conducted exams after trapping the birds to identify clinical symptoms that can occur in birds with lead poisoning. The symptoms that may be observed in condors include neurological symptoms, such as weakness, ataxia (loss of coordination), blindness, seizures, nystagmus (involuntary eye movement), head tilt, clenched toes, drooping wings, closed eyelids, tremors, and instability or the inability to stand. Additional gastrointestinal symptoms can include crop stasis, vomiting or regurgitation, green excreta, or green staining on feathers, legs or feet (in combination with other symptoms). To the extent possible, condors that are trapped and handled are evaluated for these conditions and indicators of lead poisoning (as well as any other signs of obvious disease, injury, or illness). In addition, any condors showing signs of these symptoms in the wild are closely observed and targeted for trapping so they can be examined in-hand and treated if necessary.

*Treatment*

Condors that do not show any symptoms of lead poisoning are released back into the wild, while condors exhibiting any of the aforementioned symptoms are transported to the Los Angeles Zoo for veterinary diagnosis and treatment. Treatment involves recognizing potential symptoms of lead poisoning, performing diagnostic blood tests, radiographing the condor to identify possible metallic objects in the digestive system, administering chelation treatment to remove lead from the bloodstream (Photo 2.2.1), and possibly performing surgery to remove harmful lead fragments. Chelation treatment consists of daily intramuscular injections of Calcium EDTA given in conjunction with subcutaneous fluids. Lead poisoning can result in crop stasis, or the inability to transfer food past the crop, which can result in starvation leading to severe muscle and mass loss. Treatment time varies from weeks to months depending on the level of lead exposure. Zoo veterinary staff and technicians are able to identify metallic objects in radiographic images but are not able to determine the type or composition of these objects unless recovered. Los Angeles Zoo staff closely monitor condors with metallic-positive radiographs. When possible, they recover castings and fecal material, and remove metallic objects for analysis. If the objects are determined large enough, and the condor's condition is stable, surgery may be performed to remove metallic objects as well. A condor's treatment ends when its lab blood lead level is less than 35 µg/dL, and it is no longer showing clinical signs of lead poisoning.

Condors that have endured a prolonged bout with lead poisoning will be held in captivity to physically recover from the weight loss and poor body condition that is often associated with lead poisoning. This period of physical rehabilitation often takes several months up to a year.

**Photo 2.2.1:** Los Angeles Zoo condor keepers and veterinarians prepare to chelate a lead poisoned California condor. *Photo credit: Nicole Weprin, USFWS*

*Wild Nests*

Lead poisoning may occur in chicks if a parent condor feeds the chick contaminated food. The field team also tests the blood lead levels of wild chicks during routine nest entries. Chicks also receive physical exams for signs of health issues. If warranted, treatment can also occur by evacuating the chick from the nest and transporting it to the Zoo, or through additional nest entries. However, a variety of factors such as the age of the chick and nest location, determine the ability to treat wild condor chicks (see: 2.4 Nest Management).

## 2.3 Detecting Mortalities

Identifying the causes of California condor mortalities is an important aspect of California condor recovery. Despite decades of research, the reasons for the species' decline in historic populations are poorly documented or largely inconclusive (Service 2013). Understanding the factors contributing to mortalities in the reintroduced wild populations is essential to the conservation of the species (Rideout et al., 2012). It is important to quickly identify and locate dead condors to determine the cause of death and to detect any immediate threats that may affect other condors. Detection of mortalities by radio telemetry and GPS monitoring is one of the highest priority operations conducted by the field team.

One way in which the field team detects condor mortalities is by using VHF transmitters attached to each condor. All deployed VHF transmitters have a normal frequency pulse (i.e., pulse) and an automatic mortality signal function. After a 12-hour period of inactivity, the VHF transmitter mortality function will activate, and the transmitter will emit a pulse that is about twice as fast as the normal rate (i.e., mortality signal). When a mortality signal is detected by a field team member using a telemetry receiver, it can indicate the VHF transmitter has fallen off the condor via a molted feather, the condor has not moved for some time (mortality signals can occur in the morning before the condor has moved from its roost), or the condor is gravely ill or dead.

GPS transmitter data can also alert the field team to potential condor mortalities. When reviewing condor GPS transmitter locations, stationary GPS transmitter locations for a single condor over an unusually long period of more than a day or two may indicate a mortality.

Condors are monitored by the field team throughout the day using radio telemetry at both Hopper Mountain and Bitter Creek NWRs, as well as

throughout the population's range. If a condor goes undetected for more than one week, the field team will expand their search for the missing condor by mobile tracking (Photo 2.3.1). Mobile tracking involves driving to various locations throughout the Southern California condor range to search for the signal of the missing condor. Additionally, the Santa Barbara Zoo has developed a partnership with LightHawk (lighthawk.org) to conduct aerial telemetry flights. These flights are conducted independently of the Service, do not involve Service personnel, and increase the probability of detecting condors that otherwise would not have been contacted by traditional mobile tracking.

**Photo 2.3.1:** The field team hikes out, following up on a VHF mortality signal. *Photo credit: Jessy Wilson, Great Basin Institute*

Condor chick mortalities are detected through routine nest monitoring (see: 2.4 Nest Management). Monitoring nests regularly allows the field team to identify chick mortalities immediately or shortly after they occur.

All condor carcasses recovered from the wild population are transferred to the National Fish and Wildlife Forensics Laboratory in Ashland, Oregon, for postmortem examination to determine cause of death. Condors that have not been detected either visually or remotely (VHF or GPS transmitter) for longer than one year are also considered dead and missing in the wild.

## 2.4 Nest Management

Nesting in the Southern California condor population began in 2001. Between 2001 and 2006, only two condor chicks fledged from 16 nests. During this time period, the field team identified the leading cause of nest failure due to chick mortality as the consumption of small, human-made materials (i.e., microtrash) brought to nests by parent condors. Documented microtrash items include nuts, bolts, washers, copper wire, plastic, bottle caps, glass, and spent ammunition cartridges (Mee et al., 2007; Photo 2.4.1). When a chick ingests a large quantity of microtrash, it can result in digestive tract impaction, gastrointestinal perforation, internal lesions, and death (Grantham 2007; Snyder 2007; Rideout et al., 2012).

**Photo 2.4.1:** Microtrash removed from the digestive tract of a wild California condor chick in 2008. *Photo credit: USFWS*.

In 2007, the Service partnered with the Santa Barbara Zoo to create an intensive nest management strategy referred to as the California Condor Nest Guarding Program. The program is modeled after a nest guarding program for the endangered Puerto Rican Parrot (*Amazona vittata;* Lindsey 1992). It combines monitoring nests with direct intervention to detect threats and prevent nest failure. The goals of the California Condor Nest Guarding Program are to identify the leading causes of nest failure and to increase the number of wild-fledged condor chicks in Southern California.

*Nest Searching*

The field team locates nests using visual observations, radio telemetry, and ground-truthing GPS locations of breeding age condors (Mee et al., 2007; Snyder et al., 1986). The field team first identifies pairs by monitoring courtship behaviors using visual observations or as indicated by radio telemetry data and GPS transmitter data (e.g., pair flights, nest site investigations, courtship displays, copulations; Photo 2.4.2). Existing pairs will often re-nest in previously used cavities or in cavities located close to previously used nest cavities. A nest is identified following visual confirmation of an egg. In the case of difficult-to-view cavities, nests are indicated by parent attendance behavior (switch outs in egg incubation duties, chick feeding or nestling attendance).

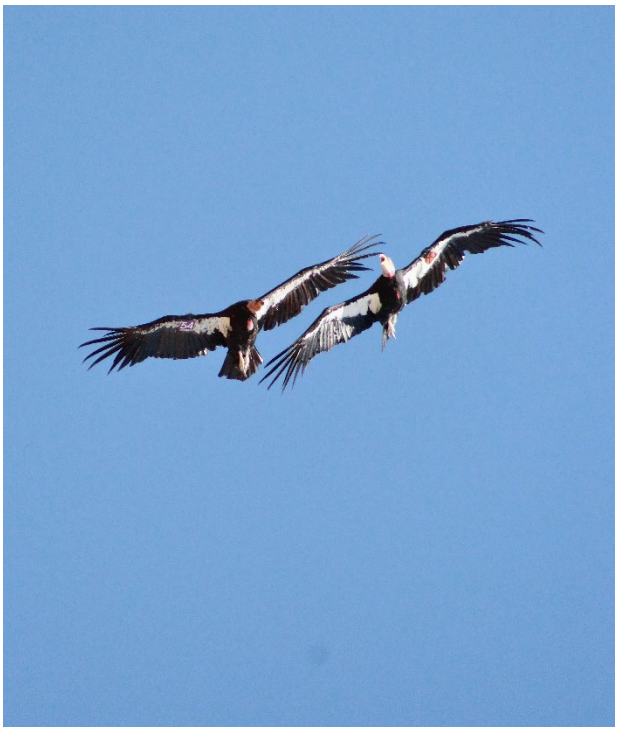


**Photo 2.4.2:** California condors #20 and #654 in a pair flight. *Photo Credit: Jimmy Rogers, Great Basin Institute.*

The field team observes nests to determine that they are still active and to monitor for any problems. Nest observers travel to a designated nest observation point and watch for activity from that location. Typically, each nest is observed from the nest observation point two to three times per week for two to four hours at a time. Remote nests are observed less frequently or not at all. Nest cavities that are not fully visible are monitored for attendance using radio telemetry or GPS transmitter locations until the chick reaches an age where it can be observed spending time outside the obscured area of the cavity.

The field team also monitors some nests with nest cameras mounted inside of the nest cavity (Photo 2.4.3). The make and model camera used in 2019 was the Axis P3367-VE. Network Camera. Nest cameras are typically installed in nests

during the first nest entry conducted during the egg stage of the nest. Not all nests are suitable for cameras. Nests need to be large enough for the camera to fit without obstructing the activity of the parent or chick and have a location to mount the camera so that the viewing angle and lighting are effective at capturing most of the parent and chicks' activity at the nest. Nest locations may also be very remote, and thus too difficult for the field team to access for camera setup and maintenance.

**Photo 2.4.3:** Nest camera and microphone installed at California condor nest, PC18. *Photo credit: Joseph Brandt, USFWS.*

The 2019 season was also the second time the field team deployed a cross-canyon camera (Photo 2.4.4). The make and model camera used in 2019 was the Axis P5635-E Mk II PTZ Dome Network Camera. This camera was installed directly across from the nest cavity on the opposite side of the canyon and provided a view of the outside of the nest cavity and the surrounding cliff face. This allowed the field team to monitor the newly fledged chick outside of the nest for the first time via camera, providing greater insight into fledgling behavior. As with nest cavity cameras, not all canyons are suitable for cross-canyon cameras. Adequate installation locations across from the nest cavity may not be present or may be too far away.

**Photo 2.4.4:** A USFWS condor field biologist stands next to the newly installed cross-canyon camera. *Photo credit: Nadya Seal Faith, Santa Barbara Zoo.*

Nests with cameras are not typically watched from an observation point. Instead, nest camera footage is streamed over a wireless network and archived. The field team reviews nest camera video footage every three to four days. Reviewers view the footage checking for parental attendance, chick activity levels, and any signs of physical distress or abnormal behavior.

Nest cameras allow observers to review nesting activity much more efficiently than direct field observations due to the ability to speed up the video during times of inactivity and more closely review events of interest. Nest cameras are programmed to record during daylight hours and capture infrequent events that are often missed by less comprehensive direct field observations. The level of observational detail is greatly increased because of the

proximity or angle of the camera to the egg, chick, and/or parents.

*Nest Entries*

The field team also monitors condor nests with regularly scheduled nest entries. Nest entries are done to check egg fertility and to confirm the hatch of an egg when it cannot be seen from an observation point or nest camera. The field team also conducts nest entries to examine chick health, assess development, and administer West Nile Virus vaccinations. This includes palpating the chick's stomach and crop for foreign bodies or blockages, taking a blood sample, weighing, and measuring tail feather length. Nests are sifted for any microtrash during each entry. Egg shells are also collected while sifting the nest. Nests are entered twice during the chick stage to examine the condor chick. These entries occur at 60 days and 120 days of age. During the 120-day nest entry, the chick is fitted with a patagial tag and VHF transmitter (Photo 2.4.5). Biologists do not enter the nest after 120 days to avoid possible premature fledging.

The field team enters nests with cameras during the egg stage to install nest cameras and when the chick is 120 days old to attach a tag and telemetry unit. Nest cameras allow the chick's development and health to be monitored remotely so chick exams prior to handling are not necessary unless the chick's health is in question.

Some condor nests are too remote, difficult, or unsafe to access for routine nest entries. These nests are monitored through visual observation or VHF and GPS tracking of the nesting adults. If a chick fledges from a remote nest, the patagial tag and VHF transmitter will be attached once the chick is trapped during the biannual trapping effort, at which time the bird will receive a West Nile virus vaccination.


**Photo 2.4.5:** USFWS biologists and an LA Zoo condor keeper attach a patagial tag and transmitter to California condor #989 at the OD19 nest. *Photo credit: Erin Arnold, USFWS*.

To enter condor nests safely, field team members are trained in using ropes to descend and ascend the steep cliff faces where nests are located. They are also trained in properly and safely handling condor eggs and chicks of various ages. The Service conducts annual ropes training at a local rock-climbing area or at partner organization field sites at the start of the nesting season. Los Angeles Zoo captive breeding personnel provide

egg and chick handling training for the field team.

*Nest Interventions*

The field team conducts nest interventions when problems arise to support success of the nest. During the egg stage, nonviable eggs (e.g., infertile, addled) are removed so there is a chance that the breeding condor pair will lay a second egg within the same breeding season; known as double clutching or recycling. In previous years (2007-2016) nonviable eggs would be replaced with viable eggs produced in captivity. This practice changed in 2017 because population models indicate that captive laid eggs that hatch and become captive releases to the wild have a higher rate of survival than captive produced eggs placed in wild nests and thus are more beneficial in increasing the population size (Bakker et al., 2017).

Additional interventions occur as needed to mitigate threats detected through observations or nest camera video monitoring, such as chick injuries, poor development, or abnormal behaviors. If a significant amount of microtrash (n > 40 items) is collected during the 60-day entry, the nest is entered again at 90 days to perform a chick health check and re-sift the nest for microtrash.

When possible, the field team uses nest cameras after interventions to continue closely monitoring the chick's condition or track parental attendance. In these instances, video footage is shared with Zoo veterinarians and behavioral experts to assess a chick's status and prognosis of recovery while it remains in the nest after treatment. The presence of cameras has allowed for interventions that would otherwise not be attempted without the ability to closely monitor the chick via the camera.

*Fledgling Observations*

When chicks fledge, they are monitored much like newly released captive-bred condors (see: 2.5 Captive Releases and Transfers). We aim to understand if fledglings are integrating into the population, displaying normal behavior, and continuing to receive parental care through observation and telemetry tracking of the young condor.

*Nest Failure*

In the event of a nest failure, biologists enter the nest to recover the remains of the egg or chick. Recovered eggs are collected and frozen in a conventional freezer for use in contaminants research. Recovered chick carcasses are submitted for necropsy to the U.S. Fish and Wildlife Service Wildlife Forensics Laboratory in Ashland, Oregon to assist in determining chick mortality factors.

*Nest Management Efficacy*

In 2015, the field team changed the nest management strategy in three ways, as described in the *2015 Annual HMNWRC Condor Field Report*. First, the number of times a nest was entered in the chick stage was reduced from four times (when the chick was 30, 60, 90, and 120 days old) to two (when the chick was 60 and 120 days old). Second, the number of entries for nests with cameras was reduced to one camera installation entry during the egg stage and one during the chick stage when the chick was 120 days

old. Finally, a new designation of a remote nest was introduced, which is not entered at all.

This protocol allowed the field team to separate the nests into two categories: managed and unmanaged. A managed nest was considered a nest that received both nest entries during the chick stage (60 and 120 days old). An unmanaged nest was considered anything that received less than that. This included camera nests since any direct management (tagging, vaccination, health check) occurred at the end of the nest stage just before fledge and largely did not impact the success of the nest up until that point, as well as remote nests since they are not entered at all.

At the conclusion of the 2019 nesting season, the field team compared the success rate of the managed nests versus the unmanaged nests for the five years under the new protocol to gain a better sense on how nest management influenced the success of recent nests in Southern California. This allowed the field team to revisit their protocols that were set in place during a time nest success was extremely low (in 2007) to see if they were still effective and appropriate practices.

Confirmed nests that failed early in the season before the field team could enter were considered unsuccessful, *unmanaged* nests. This is an important note because even though a nest might have been managed had it survived, it was still deemed unmanaged because the field team never entered the nest. This may bias the number of unsuccessful unmanaged nests slightly that otherwise would have been managed.

From 2015 to 2018, there were a total of 35 nests and of those 17 were managed and 18 were unmanaged. Nest success for managed nests was 8 out of 17, or 47%. Nest success for unmanaged nests was 8 out of 18, or 44%. Currently, 2019 is still pending the success of one nest (see section *3.4 Nest Management*) so the following numbers which include 2019 are not finalized. For the sake of this calculation, the unknown nest in 2019 was considered successful based on no evidence to confirm otherwise (see: *3.4 Nest Management*). In 2019, there were a total of 7 nests that were all unmanaged, of which 4 were successful. This would then bring the overall success of unmanaged nests to 48% and the overall success of managed nests would remain at 47%.

As these calculations show, nest success is approximately equal between managed and unmanaged nests, which suggests the current nest management protocol does not appear to have a large influence on nest success. This was not likely the case in the early stages of the program when nest success was extremely low and intensive nest management was needed but shows how the program and condors have progressed throughout the years. These comparisons aid the field team in determining best practices for future nesting seasons.

### 2.5 Captive Releases and Transfers

During the fall of each year, the field team releases captive-bred juvenile California condors into the wild at Bitter Creek NWR. The purpose of releasing captive-bred condors is to augment the wild population, offset mortalities that

occur in the wild, and ensure genetic diversity in the Southern California population of condors.

The California condor is one of many endangered species managed to maximize the genetic diversity present in the original population, minimize genetic loss, and emphasize optimal productivity (Ralls and Ballou 2004; USFWS 1996). As outlined in the 1996 Condor Recovery Plan, it is necessary to increase productivity beyond the California condor's intrinsic rate of reproduction through a captive breeding program (USFWS 1996). Captive-bred California condors selected for release in the wild must be physically healthy, successfully socialized with other release candidates, and exhibit proper behaviors. Pre-release condors are kept in isolation from humans to prevent habituation and undergo power pole aversion training to condition avoidance to landing on power poles (Bukowinski et al. 2007, Clark et al. 2007, USFWS 1996).

*Husbandry*

Prior to release, captive-bred condors spend time in a flight pen (or captive enclosure) at Bitter Creek NWR. These pre-release condors spend at least six weeks in the flight pen to allow the birds to acclimate to their new surroundings and interact with wild condors perching or feeding nearby. During this time, the field team monitors pre-release condors two to four days per week during four-hour observation periods to observe social behavior and physical health (Photo 2.5.1). On the day prior to release, the field team attaches VHF and/or GPS transmitters on each condor, and the condors are moved into a secondary enclosure within the flight pen.

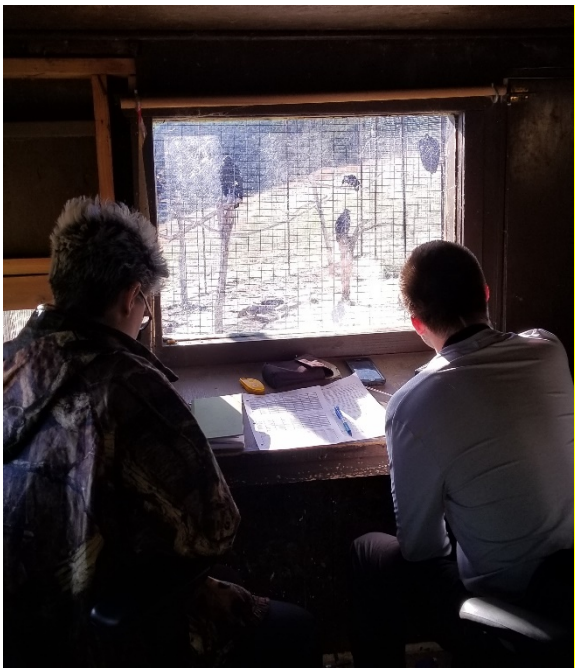


**Photo 2.5.1:** Members of the field team observe a group of pre-release condors from a blind adjacent to the Bitter Creek flight pen. *Photo credit: Molly Astell, USFWS*

*Releases*

The field team typically releases captive-bred condors during the fall months (September through November) because the weather is cooler, and there are fewer thermal updrafts. These weather conditions are conducive to keeping newly released condors close to the release site where supplemental food and water sources are available.

Condors are usually released in trios or pairs to encourage socialization. The field team monitors the newly released condors for a minimum of 30 days, paying careful attention to social interactions, feeding, and roost selection. Additional releases take place only after the previously introduced condors roost appropriately off the ground and become

familiar with the location of provided water and supplemental feeding sites.

Carrion is provided near the release pen to lure other free-flying condors in to feed and interact with the newly released condors. Supplemental feeding at bait sites for newly released birds is an integral component of the condor release program (USFWS 1996). Supplemental food and water are provided as a substitute for the parental care that the released condors would have otherwise received had they fledged from a wild nest.

The field team will trap a newly released condor and return it to captivity (temporarily or permanently) if it exhibits undesirable behavior in the wild. These detrimental behaviors include approaching humans, not socializing with other condors, roosting on the ground, and/or the inability to locate supplemental food.

## 2.6 Outreach

The field team conducts outreach to create awareness and educate the public about issues pertaining to California condor conservation in Southern California. Performing outreach for condors also furthers the Service's goals of connecting people with nature, and broadening awareness of endangered species conservation and the National Wildlife Refuge System (Photo 2.6.1). Targeted outreach can also be used as a tool to help educate specific communities that are essential in addressing threats that condors face. Non-lead Outreach and Preventing Habituation are examples of this type of targeted outreach.

**Photo 2.6.1:** CondorKids, third grade students from the Fillmore Unified School District, watch a condor feeding during a field trip to the Santa Barbara Zoo, Santa Barbara, California. *Photo Credit: Robyn Gerstenslager, USFWS.*

### *Condor Cave*

The "Condor Cave" is a Facebook page (https://www.facebook.com/TheCondorCave/) that is being managed in partnership with the Santa Barbara Zoo. The webpage has been active since 2012 and highlights the condor conservation efforts taking place in Southern California. Additionally, the webpage showcases condor courtship and nesting behaviors using video footage from the condor nest cameras.

### *Online Condor Nest Camera*

The Cornell Lab of Ornithology's All About Birds website (http://cams.allaboutbirds.org/) hosts live streaming nest cameras for many

different species. The field team partnered with Cornell Lab of Ornithology along with the Santa Barbara Zoo and the Western Foundation of Vertebrate Zoology to host a livestreaming condor nest camera online. This cooperative public outreach tool has been in use annually since 2015.

*CondorKids*

Starting in 2014, the Complex partnered with the Santa Barbara Zoo to create a new education program within the Urban Refuge Program called CondorKids. This youth outreach effort is an education program that uses the California condor to introduce students to conservation and connect them with nature.

Funded by the Urban Refuge Initiative and National Fish and Wildlife Foundation, CondorKids provides an award-winning third grade curriculum for students that meets Common Core and Next Generation Science Standards. The curriculum teaches skills in science, technology, engineering, art, and math (also known as STEAM) through diverse lesson plans that cover topics such as geography, biology, history, and conservation. All curriculum and lesson plans are available online to any interested individual or teacher (http://www.condorkids.org). The Complex and the Santa Barbara Zoo are working to develop curriculum for seventh and eighth grades, along with the CondorKids Field Guide coloring book produced this year.

Locally, CondorKids targets urban youth in Ventura County. For these local groups it also provides students the opportunity to experience condor recovery firsthand by offering field trips to the Hopper Mountain or Bitter Creek NWRs, or the Santa Barbara Zoo.

*Non-lead Outreach*

The IWS Southern California Non-lead Outreach Coordinator conducts much of the non-lead education and outreach in the range of the Southern California condor population. The major non-lead outreach activities include attending and setting up educational booths at sportsman shows and clinics, conducting shooting events, making contacts with local ranchers and providing them with free non-lead ammunition, and providing presentations for other interested outdoor organizations and groups. The IWS also hosts http://www.huntingwithnonlead.org, a webpage for hunters and shooters to help inform about how to make the switch to non-lead ammunition.

*Preventing Habituation*

The field team conducts outreach to the general public, land management agencies and organizations, and private landowners when condors come into close proximity to human activity or human structures. The goal of this outreach is to reduce the potential for condor-human conflicts, which can arise when condors perch on structures (e.g., homes, radio towers, roads) or are in regular close proximity to humans.

Condors are behaviorally flexible making them susceptible to becoming habituated to human activity and structures. This can affect their ability to survive in the wild (Cade et al. 2004). Condors can also

cause property damage and jeopardize human safety in the event that a habituated condor comes in contact with people.

A common example of this type of outreach is providing information to local residents within condor range where the potential for condor habituation with humans and structures is likely. In these cases, the field team provides information about how best to discourage condor habituation (Appendix II). This includes safe techniques for flushing condors off residences, information about installing anti-perching devices, and removing items that may attract condors to their homes.

*Other Outreach Activities*

The field team performs a number of additional types of outreach activities with the intention of creating awareness and educating the public about condor conservation issues. The Service authorizes refuge tours, co-hosts events with program partners such as the FCCWF, and presents to local schools. When possible, the Service accommodates media requests and contributes to several social media outlets and scientific publications.

# 3.0 Outcomes

## 3.1 Monitoring Resource Use

*GPS Transmitter Locations*

In 2019, 81 of 100 condors in the Southern California condor population wore GPS transmitters for at least part of the year. GPS transmitter data produced 2,537,608 locations. Six condors wearing MTI transmitters produced 516,636 locations and 75 condors wearing CTT transmitters produced 2,020,972 locations.

*Population Distribution*

Condor activity across the landscape, based on location data derived from GPS locations of the Southern California population of condors, spanned approximately 10,810 square miles (the area of a single buffered polygon derived from a kernel density estimate of all GPS locations; Figure 3.1.1). Condors from the Southern California population ranged south from Big Mountain near the city of Moorpark in Ventura County, east to the southern Sierra Nevada Range in Kern and Tulare Counties, and to the north near the town of Mariposa in Mariposa County. This marks the northernmost extent of condors from the southern California population have reached since the reintroduction was initiated in 1992. The birds ranged through eastern Santa Barbara County, north into the Los Padres National Forest's Ventana Wilderness in the Santa Lucia Mountains of Monterey County, which was the western extent of the population's range in 2019. The Tehachapi Mountains of Kern County was the area with the largest concentration of condor activity, followed by the southern portion of the Sespe Wilderness, managed by the Los Padres National Forest, in Ventura County near Hopper Mountain NWR (Figure 3.1.2). Condors also had concentrated activity near Bitter Creek NWR, though they spent less time there than in the Tehachapi Mountains or the southern Sespe Wilderness. The concentration of activity in the foothills of the southern Sierra Nevada Mountains just north of the town of Glenville continues to increase and has become the primary roosting and foraging region during the summer months.

*Activity near Wind Turbines*

Sixty-seven of the 81 condors (83%) wearing GPS transmitters were detected within two miles of industrial energy producing wind turbines in the eastern Tehachapi Mountains in 2019 (Table 3.1.1; Figure 3.1.2). Condor activity within two miles of turbines occurred every month of the year except February and December. All but one individual of the sixty-seven condors had at least one GPS location detected within two miles of a turbine with flight speeds less than 10 km per hour, indicating that these condors were perched on or close to the ground at the time the locations were collected. The first six months of the year had far fewer days of condor activity near wind turbines (17 days; n = 22 condors) than the second half of the year (125 days: n=67 condors). The most active months of condor use of the area

occurred in September and October, and the highest number of condors detected in a single day was 35 condors on September 17, 2019 (Figure 3.1.2). The number of condors detected by GPS in close proximity to operational wind energy facilities decreased from 68 condors in 2018 to 67 condors in 2019, which marks a 7% decrease adjusted for the population (74% in 2018 and 67% in 2019).

*Nest Distribution*

Condor nesting activity in 2019 occurred on public and private land. A total of seven nests were confirmed. Five nests were located in the Los Padres National Forest, all of which were in the Sespe Condor Sanctuary and Wilderness. The sixth was located on private land just west of the Hopper Mountain NWR border. The seventh was located on Bureau of Land Management land just south of Bitter Creek NWR. (Figure 3.1.3).

*Non-Proffered Feeding*

The field team confirmed four non-proffered (i.e., not provided by the field team, Photo 3.1.1) feeding events in 2019 (Table 3.1.2). Two of these carcasses were cows, one was a deer, and the other was unknown. The unknown carcass was located on private land that could not be accessed. The reported feeding events were only discovered incidentally while tracking the Southern California population of condors. It is likely that this represents only a small portion of the number of non-proffered feeding events that occurred in 2019. Many clusters of GPS locations (that often indicate feeding events) were not ground-truthed due to limited accessibility (private land) or staff; thus it is likely that many, if not most of the non-proffered feedings, went undocumented.


**Photo 3.1.1:** Condor #518 feeds on the leg of deer carcass in the Tehachapi Mountains, Kern County, California. *Photo credit: Dave Rivas*

**Table 3.1.1**: 2019 condor activity within two miles of industrial wind turbines. Stationary locations are defined as any location data point with a flight speed less than 10 km/hr.

| SB# | Stationary locations? (Y/N) | Number of individual days active within 2 miles of a wind turbine |
|---|---|---|
| 20 | N | 3 |
| 77 | Y | 7 |
| 79 | Y | 34 |
| 98 | Y | 12 |
| 156 | Y | 40 |
| 161 | Y | 20 |
| 247 | Y | 36 |
| 262 | Y | 5 |
| 289 | Y | 20 |
| 321 | Y | 4 |
| 326 | Y | 19 |
| 369 | Y | 11 |
| 374 | Y | 18 |
| 457 | Y | 15 |
| 462 | Y | 18 |
| 467 | Y | 20 |
| 480 | Y | 6 |
| 487 | Y | 28 |
| 509 | Y | 26 |
| 518 | Y | 13 |
| 542 | Y | 8 |
| 563 | Y | 14 |
| 568 | Y | 11 |
| 570 | Y | 9 |
| 585 | Y | 7 |
| 590 | Y | 23 |
| 594 | Y | 5 |
| 596 | Y | 15 |
| 599 | Y | 35 |
| 604 | Y | 28 |
| 616 | Y | 23 |
| 627 | Y | 35 |
| 636 | Y | 16 |
| 642 | Y | 9 |
| 654 | Y | 22 |
| 676 | Y | 22 |
| 712 | Y | 26 |
| 732 | Y | 28 |
| 737 | Y | 50 |
| 740 | Y | 42 |
| 748 | Y | 36 |
| 749 | Y | 2 |
| 755 | Y | 26 |
| 771 | Y | 27 |
| 772 | Y | 21 |
| 774 | Y | 36 |
| 784 | Y | 34 |
| 791 | Y | 20 |
| 794 | Y | 26 |
| 796 | Y | 28 |
| 805 | Y | 22 |
| 807 | Y | 30 |
| 811 | Y | 23 |
| 816 | Y | 24 |
| 818 | Y | 19 |
| 839 | Y | 15 |
| 846 | Y | 30 |
| 852 | Y | 26 |
| 856 | Y | 13 |
| 861 | Y | 23 |
| 862 | Y | 14 |
| 866 | Y | 2 |
| 893 | Y | 2 |
| 895 | Y | 18 |
| 933 | Y | 15 |
| 949 | Y | 42 |
| 950 | Y | 13 |
| Total | 66(Y) | 142 (days with at least one condor <2 miles from wind turbines) |

**Table 3.1.2**: Confirmed non-proffered feeding events in current (2019), years prior (2008-2018), and all years (2008-2019) by type of carrion. Non-proffered carrion is any food item that is not provided for condors by the condor field team.

| Carrion Type | Current 2019 | | Years Prior 2008-2018 | | All Years 2008-2019 | |
|---|---|---|---|---|---|---|
| **Cow** | 2 | 50% | 61 | 33% | 63 | 33% |
| **Ground Squirrel** | 0 | - | 3 | 2% | 3 | 2% |
| **Elk** | 0 | - | 4 | 2% | 4 | 2% |
| **Pig** | 0 | - | 58 | 32% | 58 | 32% |
| **Deer** | 1 | 25% | 26 | 14% | 27 | 14% |
| **Horse** | 0 | - | 8 | 4% | 8 | 4% |
| **Sheep** | 0 | - | 7 | 3% | 7 | 3% |
| **Unknown** | 1 | 25% | 9 | 4% | 10 | 4% |
| **Coyote** | 0 | - | 2 | 1% | 2 | 1% |
| **Bison** | 0 | - | 2 | 1% | 2 | 1% |
| **Goat** | 0 | - | 1 | 1% | 1 | 1% |
| **Donkey** | 0 | - | 1 | 1% | 1 | 1% |
| **Rabbit** | 0 | - | 1 | 1% | 1 | 1% |
| **House Cat** | 0 | - | 1 | 1% | 1 | 1% |
| ***Total*** | 4 | | 184 | | 188 | |

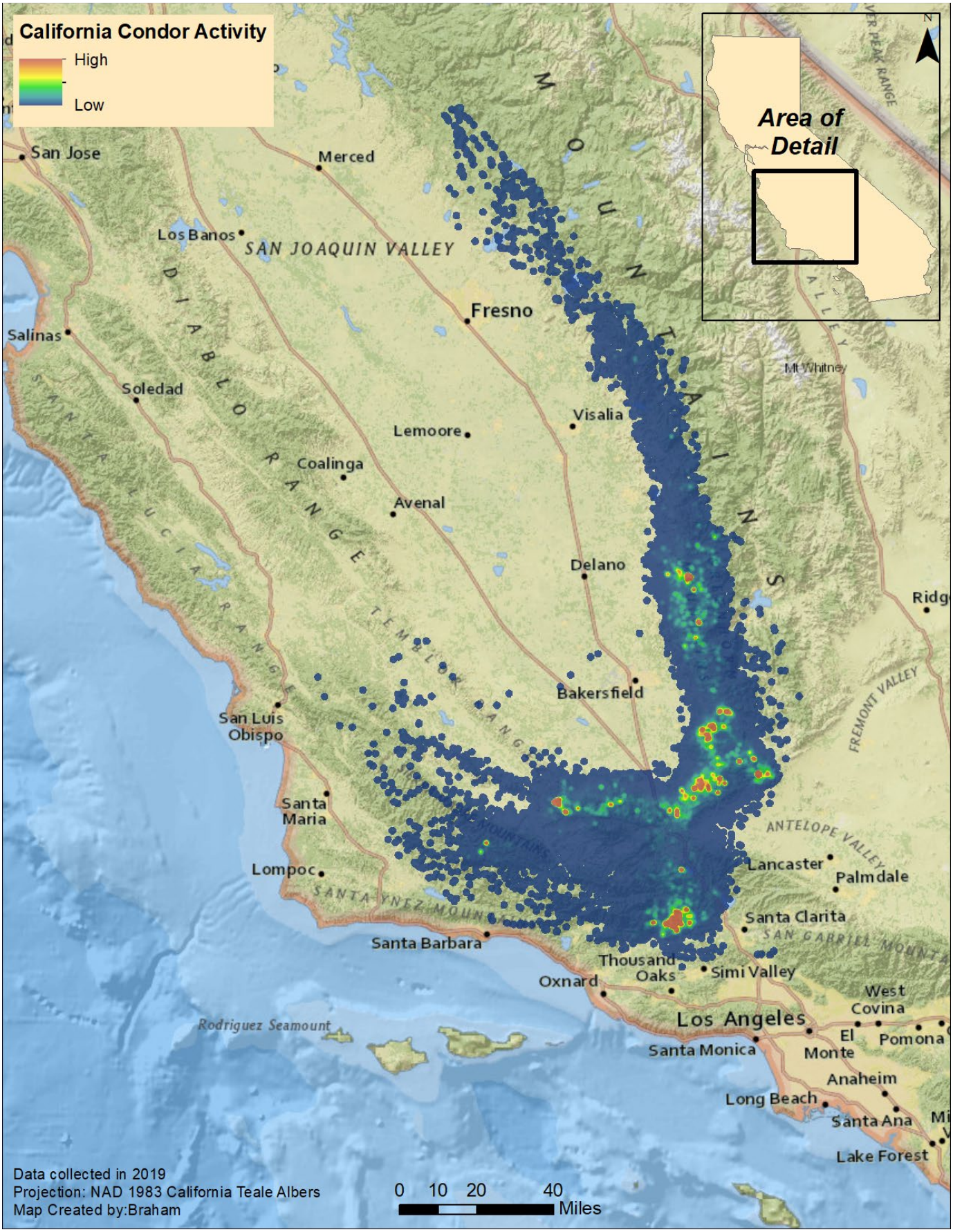



**Figure 3.1.1**: Southern California condor activity in 2019 estimated using a fixed kernel density estimate (KDE) for all California condors wearing GPS transmitters. KDE averaged across individuals (n=81) using a neighborhood of one kilometer (cell size = 100 meters) and stretched using two and a half standard deviations. KDE provided by Melissa Braham, Survey Technician (Division of Forestry and Natural Resources, West Virginia University).

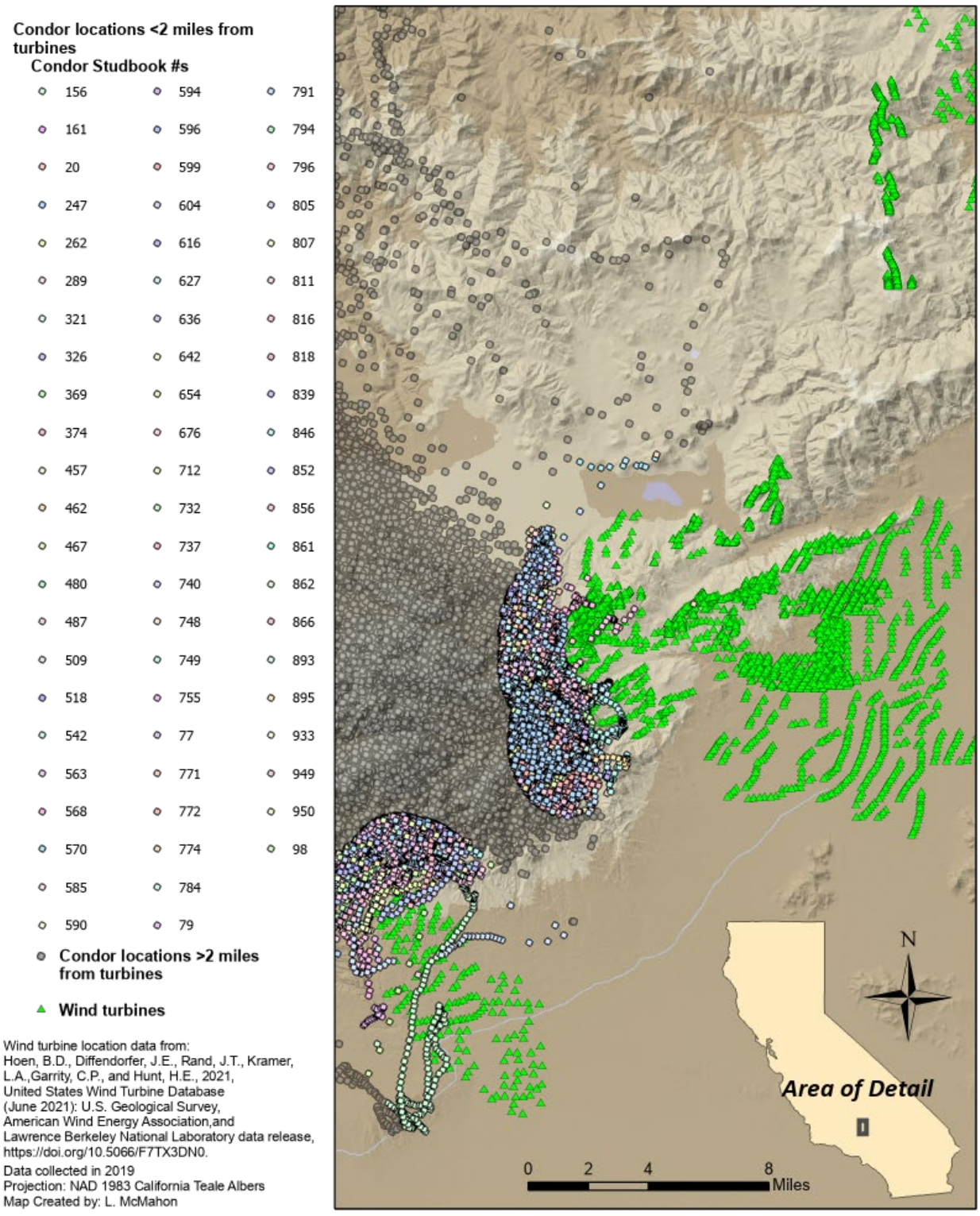



**Figure 3.1.2**: 2019 California condor locations near industrial wind turbines. 67 of the 81 condors wearing GPS transmitters (83%) flew within two miles of an operational turbine in the Tehachapi Wind Resource Area in Kern County, California.

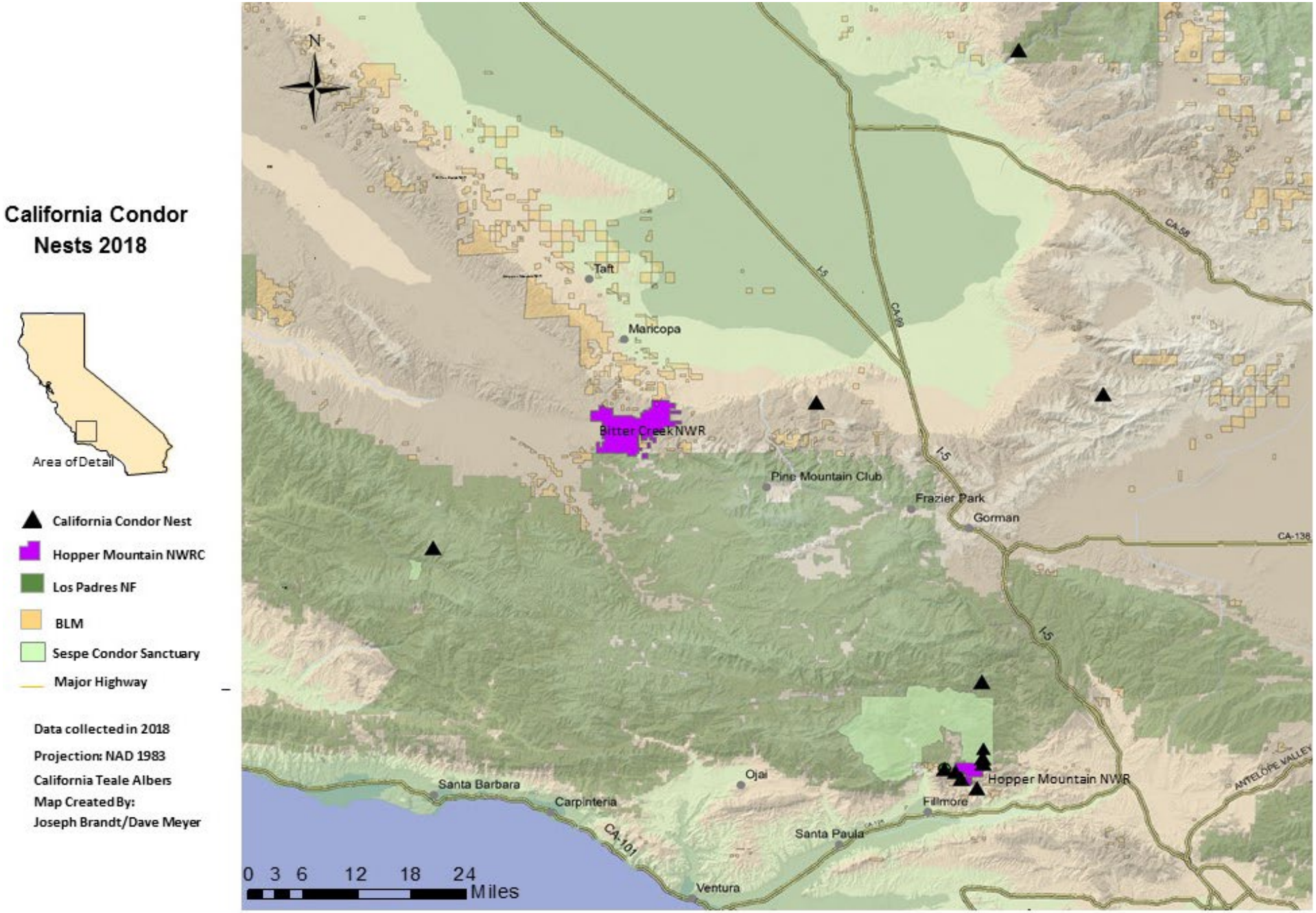



**Figure 3.1.3:** Locations of California condor nests in Southern California during 2019 (n = 7 nests).

## 3.2 Lead Monitoring and Mitigation

*Trapping Effort*

The first official 2019 trapping session to monitor for blood and feather lead levels began in May of 2019 and finished at the end of July, with the last condors being handled on July 31. Trapping began again for the second session in November and continued through mid-December, with the last birds being handled just a few days later on December 18.

The field team and volunteers spent approximately 600 hours attempting to trap condors in 2019 (Photo 3.2.1). During each trapping period, team members and volunteers spent approximately four to five days per week in trap blinds.

*Trapping Success*

During the two 2019 trapping periods, 76 of the 91 (84%) targeted condors were trapped (Table 3.2.1). There were 91 trappable condors, which differs from the end of the year population size of 99. The number of trappable condors differs from the end of year population number because it does not include captive-bred condors that were newly-released in the fall of 2019, newly wild-fledged condors, or condors that died prior to the start of a trapping period.

Condors (excluding chicks) were handled for blood and feather sampling on 21 separate days in 2019 with 1 to 20 condors handled on each occasion. Twelve of these handling days occurred during June through July and nine occurred during November through December. Each condor requires about 30-45 minutes of handling time. Depending on the number of condors needing to be handled, between 2 to 10 biologists, staff, and volunteers assisted at each handling event.


**Photo 3.2.1:** Condors feeding inside the walk-in trap at the Bitter Creek NWR flight pen, as seen from inside the trapping blind, Kern County, California. *Photo credit: Erin Arnold, USFWS*

*Blood Lead Test Results*

Blood samples from seventy-six condors in the Southern California population were tested for lead a total of 118 times in 2019 (excluding wild chicks). Thirty-seven condors were tested once in 2019. Thirty-seven condors were tested twice. Three condors were tested three times. The largest proportion of the blood lead test results in 2019 fell within the 11 to 30 µg/dL range (Figure 3.2.1). The largest proportion of blood lead test results in 2019 fell within the 11 to 30 range. This is similar to what has been seen over the past 5 years, with an exception of 2017, when the majority of results were in the 31 to 100 range. The number of results >100 µg/dL continued to decline compared to 2017, when they spiked slightly. When using the highest lab blood lead level for each condor tested, 67 of the 76 condors (88%) had blood lead levels above 10 µg/dL.

The field team tested the blood lead levels of three wild condor chicks one time each during the 2019 nesting season. At this time, condor chicks #980 and #993 had blood lead levels of 8.5 and

8.0 µg/dL respectively. At 120-days old, condor chick #989 had no detectable levels of lead in her blood.

*Treatment*

The field team only transported one condor (#819) to the Los Angeles Zoo for veterinary care and treatment because she exhibited symptoms for lead poisoning. This was a drastic reduction in the number of birds treated for lead exposure compared to years past, due in large part to the new treatment protocol starting in 2017 (see section *2.2 Lead Monitoring and Mitigation*). Were the previous protocol for treatment threshold of 35 µg/dL (as determined by a field blood lead level test) used, the total number of condors treated in 2019 would have been much higher. An estimated 24 condors would have been treated for lead exposure, had the previous treatment threshold of 35 µg/dL been used.

Condor #819 was trapped during normal trapping efforts on June 19, 2019. Over the next few days, biologists observed lethargic behavior along with other symptoms of lead poisoning. She was transported to the Los Angeles Zoo on June 25, where she was found to be emaciated and exhibiting crop stasis. Lab tests determined her blood level to be 590 µg/dL and chelation therapy was started. Five days later, surgery was performed to remove two metal fragments revealed by radiographs in her ventriculus. However, she was unable to recover and she died on July 21. Condor #819's blood was last drawn and sent for lab testing during a routine work-up almost exactly a year before her death, in June of 2018. At that time, her blood lead level was 57 µg/dL.

The skeletonized remains of condor #360 were discovered by a rancher on his property near Glennville, California on August 15, 2019. Testing showed that the remains had an elevated bone lead density and lead fragments were discovered in the ventriculus. This evidence led to the determination of the cause of death to be lead toxicosis. The last detection for this bird was via radio telemetry on August 26, 2018 and this bird had been thought to be missing in the wild until the discovery of his remains a year later. #360 was last trapped and handled at Bitter Creek NWR in January of 2017 and at that time his blood led level was 15 µg/dL.

**Table 3.2.1:** Comparison of California condors trapped at Bitter Creek NWR and Hopper Mountain NWR between sessions and in total for 2019. The number of condors targeted for trapping was the number of wild condors that needed to be trapped during each session. This number differs from the total population because condors that are newly released or fledged are typically not re-trapped until the following year.

| Trap Session (2019) | Number of Individual Condors Targeted | Number of Individual Condors Trapped | Percentage of Targeted Condors Trapped |
|---|---|---|---|
| Jan - Jul | 91 | 48 | 53% |
| Aug - Dec | 86 | 68 | 79% |
| Total | 91 | 76 | 84% |

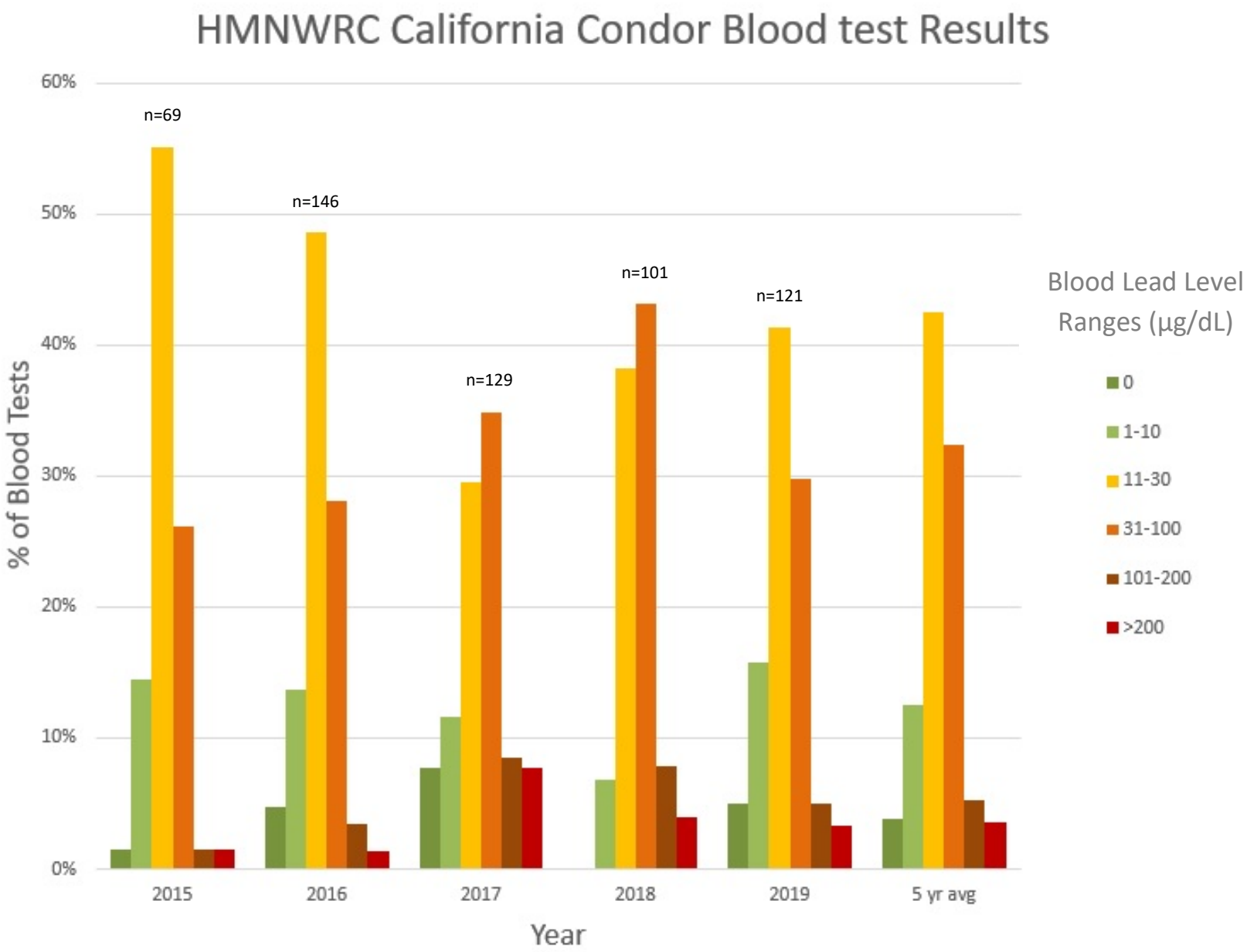



**Figure 3.2.1:** Summary of the Southern California population of condor blood lead levels by year from 2014-2019 and the 5-year average (2015-2019). All of the lead values represent lab blood lead values. Values returned as "not detected" are indicated by zero. Number of tests performed on the Southern California population of condors each year represented as "n" for each year.

### 3.3 Detecting Mortalities

Four free-flying condors died in Southern California during 2019 (Table 3.3.1). In addition to these deaths, one condor went undetected in the wild for greater than a year and was presumed dead with an approximate death date in 2018 based on the last detection. The body of that condor was discovered by a rancher in 2019. Of the 2019 mortalities, one condor died of confirmed lead toxicosis, one went missing in the wild, and one cause of death was undetermined due to the advanced state of decomposition of the body when it was found. The fourth condor's death was attributed to aspergillosis.

*Death of Condor #360*

Over the last few years, Condor #360 seldomly visited trapping sites. As such, the Field team was unable to regularly trap that bird to keep working VHF or GPS transmitters on him. His GPS began to malfunction in March of 2017, providing minimal location data, and eventually failed entirely in April of that year. He attempted to nest along the Kern River, but the nest failed in May of 2018 and #360 was infrequently detected after that period. The last detection for this bird was on August 26, 2018, when his VHF was detected from Bitter Creek National Wildlife Refuge. 355 days later, as the team was preparing to classify this bird as "missing in the wild", a rancher near Glennville, California reported finding the skeletonized remains of a condor on his property. The tag for #360 was found with the remains (Photo 3.3.1) and they were collected on August 16, 2019. While the remains of #360 were found in an advanced state of decomposition, the necropsy revealed metal particles in the ventriculus and elevated bone lead concentrations in a leg bone, strongly suggesting that he died of lead toxicosis.

**Photo 3.3.1:** Remains of condor #360, Kern County, California. *Photo credit: Joseph Brandt, USFWS.*

*Death of Condor #648*

On July 4th, 2019, the GPS data for condor #648 showed stationary hits for multiple days in a row. The location of the bird was on a private ranch west of Posey, California. After obtaining permission, Santa Barbara Zoo biologist Dave Meyer conducted a search on July 5th which resulted in the discovery of the dead condor. The remains were severely desiccated and postmortem examination was unable to reveal a cause of death.

*Death of Condor #819*

Condor #819 was trapped on June 19, 2019 during a routine seasonal trapping session. Over the next few days,

biologists observed her exhibiting strong symptoms of lead toxicosis, and she was transferred to the Los Angeles Zoo on June 25 (Photo 3.3.2). Radiographs discovered lead fragments in her ventriculus, and surgery was performed to remove them. Despite the efforts of the veterinarians, #819 continued to decline and she died on July 21, 2019. The cause of death was lead toxicosis.

**Photo 3.3.2:** Condor #819 receives treatment at the Los Angeles Zoo. *Photo credit: Nicole Weprin, USFWS*

*Death of Condor #879*

Condor #879 was observed limping on September 12, 2019 while biologists were attempting to trap birds during a routine seasonal trapping session. They were able to trap her and transfer her to the Los Angeles Zoo, where the veterinary team determined she had a severely broken leg that was 4-6 weeks old. Surgery was performed to correct the broken leg, and then again after the original plate bent. #879 showed signs of recovering and was moved into an exterior recovery pen, however on December 21 she was observed as lethargic and exhibiting heavy breathing. On December 22 condor #879 stopped breathing altogether. The cause of death was determined to be presumptive aspergillosis which caused a cerebral hemorrhage and organ failure.

**Table 3.3.1**: California condor mortalities within the Southern California population in 2019.

| Studbook ID | Sex | Hatch Date | Mortality Date | Cause of Death | Location of Death |
|---|---|---|---|---|---|
| 360 | M | 3-May05 | 27-Aug-18 | Lead Toxicosis | CA; Kern County |
| 648 | F | 23-Apr-12 | 20-Jun-19 | Undetermined | CA; Tulare County |
| 819 | F | 04-Sep-16 | 21-Jul-19 | Lead Toxicosis | CA; Los Angeles Zoo |
| 879 | F | 23-Apr-17 | 22-Dec-19 | Infection, Aspergillosis | CA; Los Angeles Zoo |

## 3.4 Nest Management

The first egg of the 2019 nesting season was laid on February 9, and the nesting season ended on January 19, 2020 when the last chick of the season fledged. There were seven active nests during the season (Table 3.4.1).

Three of this year's breeding pairs had nested previously as pairs. Four were first-time pairs. One of these first-time pairs established a new territory in Ventura County, resulting in an expansion of the range of recent nests in Southern California. This was also the first ever breeding attempt for four of the condors that paired this year.

*Nesting Success*

Nesting success, calculated as the total number of chicks fledged out of the total number of nests, has increased since nest guarding was implemented across all southern California condor nests in 2007 (Figure 3.4.1). However, one of the nests of the 2019 season was remote and nest success is pending. GPS data suggests the chick survived and fledged but it has not yet been confirmed in the field. If this nest was successful then four of the seven nests in 2019 had chicks that fledged, resulting in 57% nesting success. If this nest was not successful, then three of the seven nests in 2019 had chicks that fledged, resulting in 43% nesting success.

**Table 3.4.1:** California condor nesting attempts and outcomes for the 2019 Southern California breeding season. Sire and Dam Studbook Number are the studbook numbers of the male and female attending the nest respectively. Chick Studbook Number is the studbook number of the chick that hatched in the wild nest.

| Nest Identification | Date Nest Located | Sire Studbook Number | Dam Studbook Number | Egg Identification | Lay Date | Date Hatch | Chick Studbook Number | Number of Nest Entries | Nest Fate |
|---|---|---|---|---|---|---|---|---|---|
| PC19 | 22-Feb | 262/326* | 563 | FW119 | 13-Feb | 10-Apr | 980 | 2 | Fledged, 14-Oct-19 |
| LW19 | 2-Mar | 247 | 156 | FW219 | 9-Feb | NA | NA | 0 | Failed, 7-Apr-19 |
| SR19 | 28-Feb | 636 | 642 | FW319 | 16-Feb | NA | NA | 0 | Failed, 4-Mar-19 |
| OD19 | 10-Mar | 328 | 216 | FW419 | 10-Mar | 5-May | 989 | 4 | Fledged, 28-Oct-19 |
| RC19 | 26-Mar | 627 | 648 | FW519 | 28-Feb | NA | NA | 0 | Failed, 2-May-19 |
| DG19 | 12-Apr | 206 | 518 | FW619 | 19-Mar | 15-May | 993 | 2 | Fledged, 19-Jan-20 |
| HW19 | 12-Apr | 467 | 576 | FW719 | 19-Mar | 15-May | 998 | 0 | Unknown** |

*326 was the biological sire but 262 reared the chick with 563.
** HW19 is remote and success of the nest is pending; GPS data suggests chick survived and fledged but has not yet been confirmed in the field.

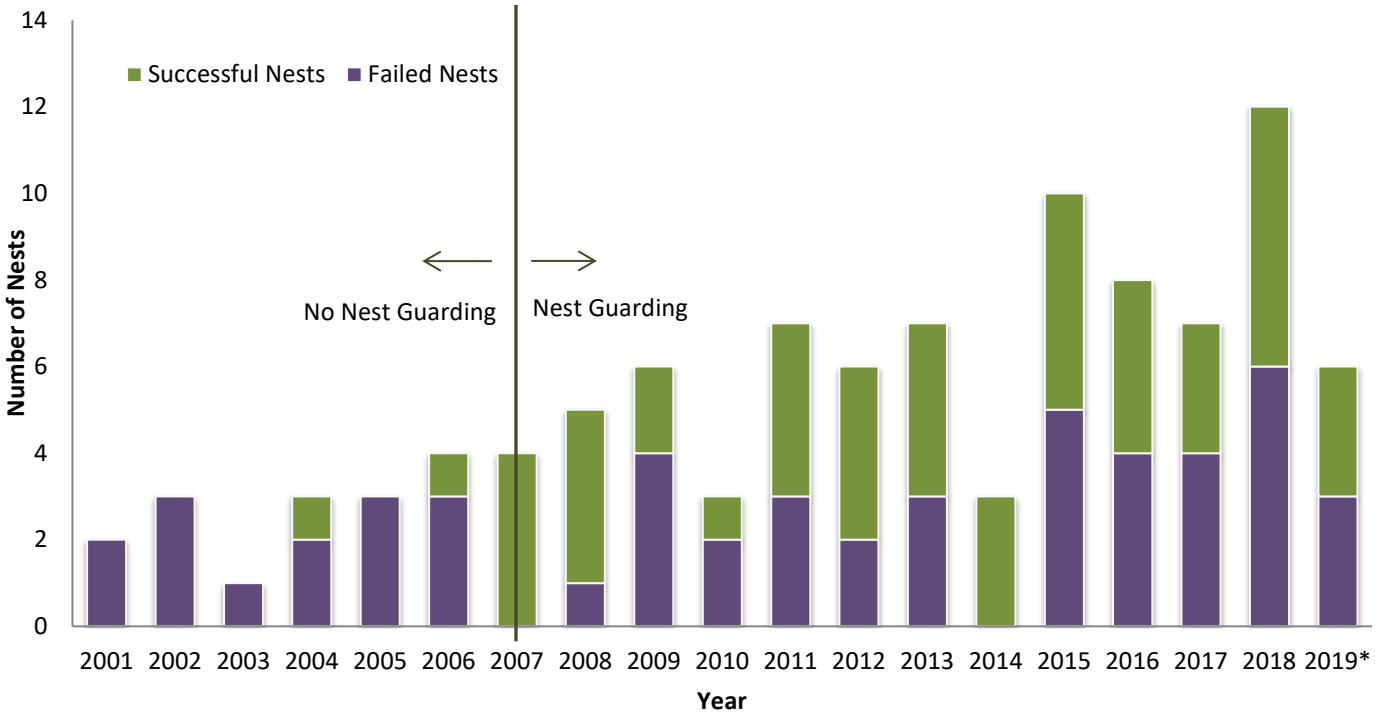



**Figure 3.4.1**: California condor nesting success in Southern California before and after implementation of the Nest Guarding Program (2001-2019). Nests are defined by pairs or trios of condors that produce at least one egg. Nesting success is any nest where a chick fledges from the nest.
**2019 pending success of HW19. HW19 is remote and success of the nest is unknown; GPS data suggests chick survived and fledged but has not yet been confirmed in the field. It is currently not added to the Successful Nests category or the Failed Nests category.*

### *Nest Observations*

In 2019, condor nests were observed over the course of the breeding season using direct observation via spotting scopes, binoculars, and/or nest cameras. Nest cameras were used for monitoring three of the nests: PC19, OD19, and DG19. PC19 was streamed live online to a worldwide public audience through a partnership with Cornell Lab of Ornithology, while OD19 and DG19 were accessible only to the field team on local networks at Hopper Mountain and Bitter Creek NWRs. The camera for OD19 was installed in 2017 during a previous nesting attempt. The PC19 camera was installed during the first entry where the field team found a recently hatched chick. The DG19 camera was also installed during the first nest entry and recorded the hatch of the chick.

Chicks and fledglings were directly observed for a total of 502 observation hours taking place over 138 observer days. Unpaid volunteer observer hours accounted for 53% of all observation hours (Table 3.4.2). For nests with cameras, observers checked nest activity daily and reviewed video footage in detail every two to three days each week. The field team spent 345 hours reviewing 8,242 hours of video footage.

**Table 3.4.2**: California condor nest observation hours by personnel type.

| Personnel Type | Observation Hours |
|---|---|
| Service Staff | 8 |
| Santa Barbara Zoo Staff | 53 |
| GBI Research Associates | 176 |
| Unpaid Volunteers | 265 |
| Total Observation Hours | 502 |

### *Nest Entries*

The field team performed 8 nest entries (Photo 3.4.1) over the course of the year. Each entry required two to six personnel for eight to twelve hours to drive, hike, perform the check, and return to the office. Santa Barbara Zoo staff assisted on 7 of these entries, and the Los Angeles Zoo staff assisted with one entry. In lieu of more frequent nest entries, nest cameras were a useful tool for monitoring and ensuring proper chick development.

**Photo 3.4.1:** Santa Barbara Zoo biologist, Dave Meyer, rappels down to condor nest PC19. *Photo credit: Molly Astell, USFWS*

### *Nest Fates*

Condor nest PC19 was entered on two occasions. At the first entry, the field team discovered a chick that had hatched that day, condor #980. The field team also installed a nest camera during this entry. It was entered a second time to tag the chick when it was 120 days

old. The field team took blood samples to test for sex and lead exposure and administered a West Nile virus vaccine. About three weeks prior to this second nest entry, the field team also installed a Cross-Canyon camera which did not involve entering the nest. Condor #980 fledged on October 14, 2019 and was monitored for the following month via the Cross-Canyon Camera to ensure that it was thriving and continued to receive care from its parents. This was condor #262 and #563's first nesting attempt together as a pair and their first successful fledge.

Condor nest LW19 was not entered during this nesting season. Condor #247 and #156 have a record of laying infertile eggs so the field team decided to wait for the egg to hatch before attempting a nest entry since the egg was fully visible in the cavity from an observation point. A week after the expected hatch date it was clear the egg was infertile and was not going to hatch. Typically, the protocol calls for removing the infertile egg in order to prompt the pair to potentially lay another egg. However, the approach to this nest is difficult and time and resources did not allow for this to occur at that time. The infertile egg was not removed by the field team and eventually was abandoned by the pair. Condors #247 and #156 did not attempt to re-nest. This was their fourth nesting attempt together as a pair.

Condor nest SR19 was located in a new territory near Hopper Mountain NWR and marks the first recorded condor nest in this area (Photo 3.4.2). Unfortunately, it failed before the team could schedule a nest entry. The nest was discovered on February 28, 2019 when the dam, condor #642, stood up from incubating and the egg was visible in the cavity. Four days later, the egg was discovered missing from the cavity during an observation. The parents then abandoned the nest. It is unknown what happened to the egg. The field team did not enter the cave to look for egg remains in case the pair decided to re-lay this season. They did not attempt to re-nest. This was both condor #636 and #642's first ever nesting attempt.

**Photo 3.4.2:** The newly discovered SR19 nest, circled in red. *Photo credit: Nicole Weprin, USFWS*

Condor nest OD19 was entered on four occasions. The first entry was to check the fertility of the egg and to make adjustments to the nest camera. At the time of this entry the egg was only three days old and it was too early to tell the fertility of the egg. Neither condor in this pair had a GPS unit so it was unclear when they had actually started nesting at that point. The second nest entry was conducted to determine the egg's fertility and age to inform later nest entry dates. Through candling of the egg, it was confirmed to be fertile. The third nest entry was conducted only to clean the

camera lens that had been covered with excrement throughout the season.

OD19 was entered a fourth time to tag the chick, #989, when it was 123 days old. The field team took blood samples to test for sex and lead exposure and administered a West Nile virus vaccine. During this last entry, the field team also moved the nest camera from inside the cavity to a rock face across from the nest cavity. This allowed the field team to continue to remotely monitor the chick via camera as it spent more time outside of its nest cavity and throughout the fledgling stage. Condor #989 fledged on October 28, 2019 and was monitored for the following month via camera to ensure that it was thriving and continued to receive care from its parents. This was condor #328 and #216's fifth nesting attempt together as a pair and their second successful fledge.

Condor nest RC19 was not entered during this nesting season. This was a difficult nest to enter, so the field team monitored parental attendance via GPS to confirm egg hatch before attempting a nest entry. This nest was monitored via GPS after visual confirmation due to its remote location and failed for unknown reasons before the team conducted an entry. Regular parental attendance dropped off around the estimated hatch period, and on May 2, 2019, both parents were observed via GPS roosting away from the nest. This would have caused the nest to definitively fail if it had not already, due to inadequate incubation. Condor #648 died later that summer. This was both condor #627 and #648's first ever nesting attempt.

Condor nest DG19 was entered on two occasions. The first entry was to check the fertility of the egg and install a nest camera. The egg was confirmed to be viable through candling. The field team entered the nest a second time to tag the chick (#993), when the chick was 119 days old. The field team took blood samples to test for sex and lead exposure and administered a West Nile virus vaccine. Unlike most other nest cameras, the field team was unable to move the nest camera from inside the cavity to the outside due to a lack of suitable locations to mount the camera. As the chick grew older and spent more time outside of the nest cavity, the field team focused more on in-field observations as they could not monitor the chick via the camera as effectively.

While the chick was still spending time in the camera view, field team members noticed the chick had a wing injury. On September 18, 2019, the chick was in the cavity with parent #206. On this morning and the days leading up to it, the chick appeared normal and both wings were functioning properly. On September 18th, #206 and the chick exited the cavity and were gone for approximately 5 hours. When they returned, the chick walked to the center of the cave, laid down, and then #206 preened the chick. The chick did not stand up for the rest of the day. The next day and onwards the chick's left wing had an extreme droop to it but only when resting. Observing the chick closely via camera, the chick was still able to use its wings bilaterally and both functioned normally when the chick was actively using its wings (i.e., during wing begging, hop wing flapping). The wing

would only appear to droop when the chick was resting.

Because the chick appeared to still have use of the wing, the field team decided not to intervene and to wait and see if the chick would be able to fledge. Since the chick was over 6 months old at the time the injury was discovered, any efforts to capture and evacuate the chick had a high risk of force-fledging. This could have caused the chick even more injuries or lead to its demise, and it was uncertain whether it was possible to capture the chick at all. Experts at the LA Zoo reviewed video footage of the injured wing and agreed it was promising that the chick was still able to use its wings bilaterally. They also suggested leaving the chick and waiting to see if it would be able to fledge.

Condor #993 fledged over two months later than the average chick on January 19, 2020. The field team monitored the fledgling over the following month via in-field observations to ensure that it was capable of flight and continued to receive care from its parents. This was condor #206 and #518's first nesting attempt as well as their first successful fledge together as a pair.

Condor nest HW19 was considered a remote nest and was not entered during this nesting season. Regular observations were not conducted due to the area being exceptionally challenging to access. The field team did make an effort to search for the nest but did not pinpoint the actual cavity due to the difficult terrain. The chick was considered successfully hatched based on the GPS activity of condor #467 (condor #576 did not have a functioning GPS) producing condor #998. He maintained a regular GPS pattern through the first 30 days of the chick's life, in the pattern expected if a chick had hatched. His GPS data then continued to show him active at the nest site all throughout the nesting season. There was no indication via #467's GPS data that the nest had failed at any point.

It is unknown if the chick successfully fledged and the field team will not be able to confirm the success of this nest until the chick is trapped at a release site and its identity confirmed through blood sampling for parentage. If the chick fledged around the average six months of age, it would have fledged approximately around 11 November 2019. This was condor #467 and #576's second nesting attempt and potentially their second successful fledge together as a pair.

**Table 3.4.3:** Microtrash recovered from nests of each pair of California condors during 2002-2019 seasons. Values represent the total number of trash items collected from each nesting attempt or associated chick each year

| Pair | Year | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 |
| 20/654 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 0* | 1 | - |
| 21/192 | - | - | 109 | 235 | 1* | 233 | - | 60 | - | 3* | - | 164 | - | 244 | - | - | - | - |
| 21/289 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 104 | - | - | - |
| 63/147 | - | - | - | - | - | - | - | - | - | - | - | 0 | - | - | - | - | - | - |
| 98/155 | 125 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 98/216 | - | - | - | 5* | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 98/112 | - | - | - | - | na | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 98/289 | - | - | - | - | - | - | 322 | 12* | - | - | - | - | - | unk* | - | - | - | - |
| 100/108 | 54 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 107/156 | - | - | - | - | - | - | - | - | - | - | - | 0 | - | - | - | - | - | - |
| 125/111 | 0 | 44 | 57 | 43 | - | 43 | 11 | 10* | 26 | 3 | 9* | 189 | 16 | - | - | - | - | - |
| 107/112 | 15 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 107/161 | - | - | unk | - | 46 | 19 | 26 | 103 | - | 56 | - | 49 | - | 125 | - | 2* | - | - |
| 206/255 | - | - | - | - | - | 39 | - | 52 | 32* | - | - | - | - | - | - | - | - | - |
| 206/370 | - | - | - | - | - | - | - | - | - | - | 34 | - | - | - | - | - | - | - |
| 206/513 | - | - | - | - | - | - | - | - | - | - | - | - | - | 0 | unk* | 15 | - | - |
| 206/518 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 0 |
| 237/214 | - | - | - | - | 65 | - | 115 | - | - | - | - | - | - | - | - | - | - | - |
| 237/255 | - | - | - | - | - | - | - | - | - | 36 | - | 53 | - | 12 | - | - | - | - |
| 237/563 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 0* | - |
| 239/289 | - | - | - | - | - | - | - | - | - | - | 2 | - | - | - | - | - | - | - |
| 247/79 | - | - | - | - | - | - | 0 | unk | 0* | 10 | 1 | 31 | 21 | 15* | - | - | - | - |
| 247/156 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 72 | unk* | 1* | unk* |
| 262/449 | - | - | - | - | - | - | - | - | - | - | - | - | - | 8 | - | - | - | - |
| 262/563 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 52 |
| 326/364 | - | - | - | - | - | - | - | - | - | 0* | - | - | - | - | - | - | - | - |
| 326/518 | - | - | - | - | - | - | - | - | - | - | - | - | - | 45 | - | - | 25 | - |
| 328/216 | - | - | - | - | - | - | - | - | - | 22 | 1* | 3* | - | - | - | 2 | - | 0 |
| 360/596 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | unk* | - |
| 365/487 | - | - | - | - | - | - | - | - | - | - | - | - | - | unk* | unk* | - | - | - |
| 369/483 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 26 | - |
| 374/180 | - | - | - | - | - | - | - | - | - | - | 66 | - | 46 | - | - | - | - | - |
| 374/79 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 10 | - | - | - |
| 374/289 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 118 | - |
| 457/507 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | unk* | unk* | - |
| 462/594 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 105 | - |
| 467/576 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | unk | - | unk |
| 509/111 | - | - | - | - | - | - | - | - | - | - | - | - | - | 93 | 31 | - | - | - |
| 509/161 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 154 | - |
| 585/493 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | unk* | - |
| 590/604 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | unk | - |
| 627/648 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | unk* |
| 636/642 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | unk* |
| ?/156 | - | - | - | - | - | - | - | - | - | - | - | - | 0 | - | - | - | - | - |
| Average | 48.5 | 44 | 83 | 139 | 55.5 | 83.5 | 94.8 | 71.7 | 26 | 25.4 | 25.8 | 69.4 | 20.8 | 75.3 | 54.3 | 8.5 | 71.5 | 17.3 |

*Nest failed prior to the chick being 90 days of age, value was not included in the average

## 3.5 Captive Releases and Transfers

In 2019, the field team released thirteen captive-bred condors into the wild at Bitter Creek NWR (Table 3.5.1). Releases occurred during the months of October, November, and December. One of the condors released, #108, was an adult that was first released as a juvenile in August 1995 at the Lion Canyon release site. This condor was brought into captivity 13 years after her first release and held as a captive breeder at the Oregon Zoo until 2019, when she was transferred to Bitter Creek NWR for re-release into the wild. She became a candidate for release because her genetics were no longer optimal for captive breeding purposes.

Juvenile condor (#870) was released in 2019, after its initial release in 2018 was delayed due to spinal injury. Unfortunately, this condor was recaptured 6 days after release into the wild due to failure to thrive. The other 11 condors released into the wild for the first time were juveniles approximately one and a half years of age. Prior to release, the 13 condors were held in the flight pen on site for a minimum of five weeks starting in early August.

*Transport and Husbandry*

The condors intended for release into the wild were held in the Bitter Creek NWR flight pen. Eight condors, #870, #934, #935, #940, #942, #944, #945, and #951 were transferred to Bitter Creek from the World Center for Birds of Prey (WCBP) on August 10, 2019. On September 16, 2019, one condor, #108, was transferred to Bitter Creek from the Oregon Zoo. The remaining four condors, #911, #916, #939, and #941, were transferred to Bitter Creek from the Los Angeles Zoo on October 15, 2019.

The field team conducted visual health checks on the condors in the flight pen on a daily basis and detailed four-hour behavioral observations two to three days per week. The field team provided the captive condors regular food and water while held in the flight pen. One member of the field team was present on site and overnight in case of emergency.

*Condor Releases*

Fall releases of captive-bred condors began at Bitter Creek NWR on October 16, 2019. The day prior to their release, the field team handled the condors to attach a wing tag, and VHF transmitters and/or a GPS transmitter to each individual (Photo 3.5.1). The 13 condors were released from the Bitter Creek NWR Flight Pen in groups of two to three over the next two and a half months (Table 3.5.1).

**Photo 3.5.1:** The field team enters the flight pen to net a young captive condor in order to outfit it for its release into the wild the following day. *Photo credit: Nicole Weprin, USFWS*

*Post Release Monitoring*

The thirteen newly released captive-bred condors were closely monitored by the field team for appropriate feeding and roosting behaviors after release (Photo 3.5.2). Monitoring required an average of two people per week for approximately 10 hours per day from October 16, 2019 until December 31, 2019 (Table 3.5.2). Releasing the birds in smaller groups, rather than all at once, allowed the field team to more closely observe the behaviors of each group. Each group of condors was observed exhibiting proper roosting and feeding behavior prior to moving on to the release of the next group.

At the end of 2019, all but one of the thirteen newly released condors had successfully integrated into the wild flock by roosting in trees and feeding with other condors.

**Photo 3.5.2:** A member of the field team scans for the frequency of a newly released condor in order to pinpoint its location. *Photo credit: Serena Stumpf, Great Basin Institute*

*Re-capture of Condor #870*

Condor #870 hatched on April 18, 2017 at the WCBP. She was parent-reared and transferred to a group socialization pen on November 27, 2017 when she was approximately seven months old. Notes from the keepers describe the chick appeared healthy and strong. She did well during her first four hours in the pen and was flying between perches and perching next to other birds. However, later that evening of the 27th she was discovered on the ground unable to fully stand or walk. Further examination revealed she had suffered spinal trauma but had no detected sever of the spinal column. The WCBP staff treated the bird and monitored her progress over the next year and a half. She showed marked improvement over that time and was deemed releasable for 2019.

Condor #870 spent two months in the Bitter Creek NWR flight pen, and during this time the field team observed her behaving normally. She interacted and fed with the other captive condors, and there were no indications that #870 would not be a good candidate for release. She had several damaged tail feathers, also noted by the keepers at the WCBP, but this did not seem to hinder her movement throughout the flight pen.

Condor #870 was released on November 13, 2019 and it quickly became apparent that she was not exhibiting normal condor behavior and would not roost above the ground. She made a few failed attempts to perch above ground but spent most of her time hiding in the bushes located within the predator fence of the Bitter Creek Flight Pen. The field team closely monitored her over several days and only observed one unsuccessful flight to reach the top of the flight pen, but otherwise she never left the ground. Six days later, on November 19, 2019 the field team re-captured #870 via a net gun and transferred her to the Los Angeles Zoo.

*Population Increase*

Loss of free-flying condors from mortalities and gains from new releases and wild reproduction resulted in an end-of-year population size of 99 condors; an 8.8% increase to the Southern California population in 2019 (Figure 3.5.1). However, 2019 is still pending the success of a remote nest (see section *3.4 Nest Management*). GPS data suggests the chick survived and fledged but this has not yet been confirmed in the field due to the inaccessibility of the nesting territory. This chick was not counted in the total Wild Fledged or the Total Population.

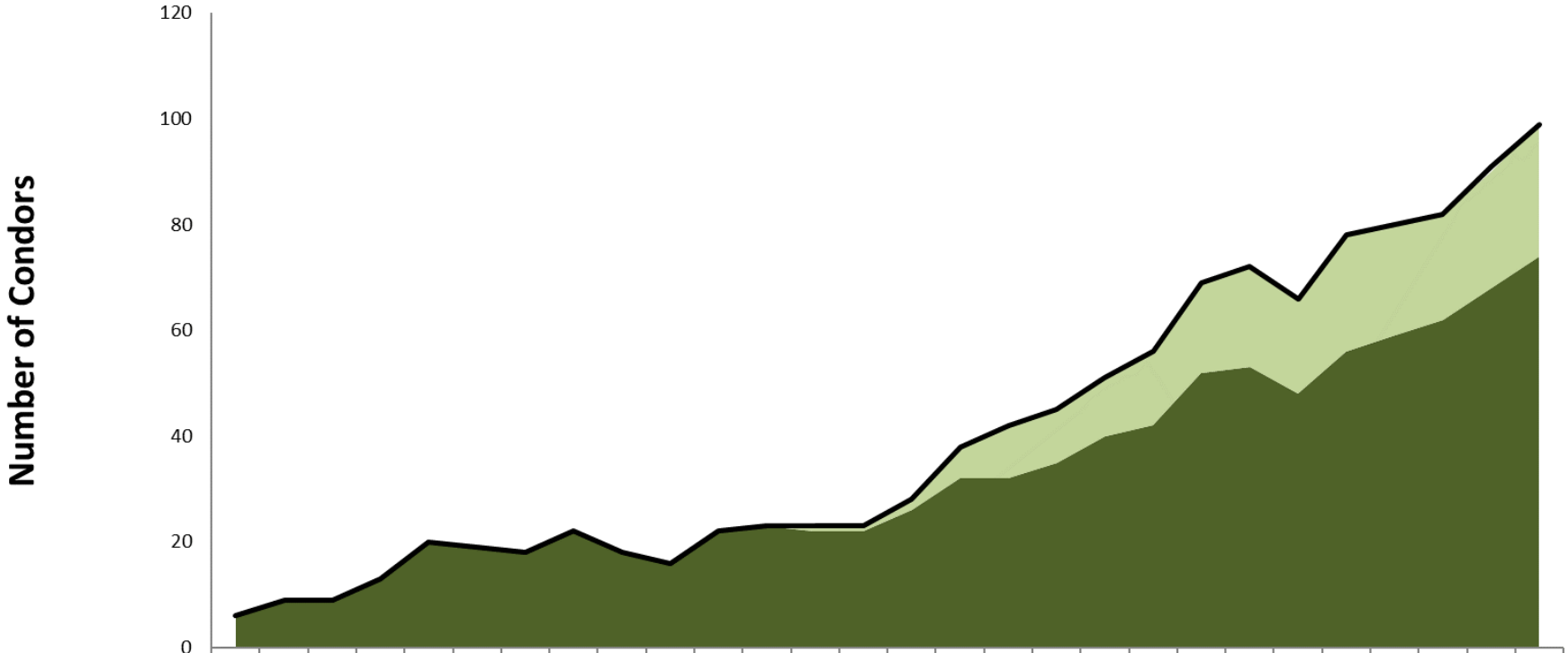
**Table 3.5.1**: California condors released at the Bitter Creek NWR in 2019. A successful fate indicates that the released condor was alive and remained in the wild population without having to be recaptured as of the end of each calendar year.

| SB# | Sex | Hatch date | Hatch location | Transfer date | Release date | Fate | Age at Release (in years) |
|---|---|---|---|---|---|---|---|
| 108* | f | 28-Mar-94 | Los Angeles Zoo | 16-Sep-19 | 11-Dec-19 | Successful | 25.7 |
| 870** | f | 18-Apr-17 | World Center for Birds of Prey | 10-Aug-19 | 13-Nov-19 | Unsuccessful | 2.6 |
| 911 | m | 27-Mar-18 | Los Angeles Zoo | 15-Oct-19 | 27-Nov-19 | Successful | 1.7 |
| 916 | m | 5-Apr-18 | Los Angeles Zoo | 15-Oct-19 | 11-Dec-19 | Successful | 1.7 |
| 934 | f | 27-Apr-18 | World Center for Birds of Prey | 10-Aug-19 | 30-Oct-19 | Successful | 1.5 |
| 935 | m | 30-Apr-18 | World Center for Birds of Prey | 10-Aug-19 | 30-Oct-19 | Successful | 1.5 |
| 939 | f | 3-May-18 | Los Angeles Zoo | 15-Oct-19 | 11-Dec-19 | Successful | 1.6 |
| 940 | f | 10-May-18 | World Center for Birds of Prey | 10-Aug-19 | 16-Oct-19 | Successful | 1.4 |
| 941 | m | 10-May-18 | Los Angeles Zoo | 15-Oct-19 | 27-Nov-19 | Successful | 1.6 |
| 942 | f | 15-May-18 | World Center for Birds of Prey | 10-Aug-19 | 16-Oct-19 | Successful | 1.4 |
| 944 | f | 29-May-18 | World Center for Birds of Prey | 10-Aug-19 | 30-Oct-19 | Successful | 1.4 |
| 945 | m | 30-May-18 | World Center for Birds of Prey | 10-Aug-19 | 13-Nov-19 | Successful | 1.5 |
| 951 | f | 15-Jun-18 | World Center for Birds of Prey | 10-Aug-19 | 16-Oct-19 | Successful | 1.3 |

* Condor was released after several years of captivity. **Condor re-captured shortly after 2019 release.

**Table 3.5.2**: Field team efforts to release captive-bred California condors in 2019 at Bitter Creek NWR.

| | 2019 | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | January | February | March | April | May | June | July | August | September | October | November | December |
| Number of condors released | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 4 | 3 |
| Approximate staff hours tracking new releases | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 520 | 665 | 450 |
| Total number of calf carcasses provided | 3 | 3 | 6 | 4 | 6 | 14 | 23 | 8 | 11 | 16 | 31 | 29 |




| | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Wild Fledged | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 2 | 6 | 10 | 10 | 11 | 14 | 17 | 19 | 18 | 22 | 21 | 20 | 22 | 25 |
| Captive Released | 6 | 9 | 9 | 13 | 20 | 19 | 18 | 22 | 18 | 16 | 22 | 23 | 22 | 22 | 26 | 32 | 32 | 35 | 40 | 42 | 52 | 53 | 48 | 56 | 59 | 62 | 68 | 74 |
| Total Population | 6 | 9 | 9 | 13 | 20 | 19 | 18 | 22 | 18 | 16 | 22 | 23 | 23 | 23 | 28 | 38 | 42 | 45 | 51 | 56 | 69 | 72 | 66 | 78 | 80 | 82 | 91 | 99 |

**Figure 3.5.1:** Number of wild California condors within the Southern California population from 1992 through 2019. The size of the population represents the number of condors at the end of each calendar year. Note: 2019 is still pending the success of a remote nest; GPS data suggests chick survived and fledged but has not yet been confirmed in the field. This chick was not counted in total Wild Fledged or Total Population.

## 3.6 Outreach

Using outreach to raise awareness about condor conservation continued to be a growing activity for the field team in 2019. The field team continued to assist with non-lead outreach, expand its following on social media, initiate new programs, and build upon existing outreach efforts.

*Condor Cave*

Throughout 2019, interest and engagement by the public in the Condor Cave Facebook webpage increased, with a total of 15,292 followers at the end of the year. This was a 1.55% increase as compared to 2018 (15,059 followers). The Santa Barbara Zoo staff plays the primary role in developing the content for this page, providing two to three posts a week. Posts included photos, nest camera videos, and updates from the Southern California field team and other condor release actions within the larger California Condor Recovery Program. Over 6,500 people were estimated to be reached by the page's most popular post.

*Online Condor Nest Camera*

The live-streaming condor nest camera went live on May 22, 2019 when the chick was 42 days old. Viewers were able to observe condors #563 and #262 raise their chick, #980. This is the second year viewers could watch from both a close-up view inside the nest, and later from a cross-canyon camera (Photo 3.6.1). Viewers watched as the chick explored the world in and outside the nest cavity and observed the fledging process. Condor #980 fledged on camera on October 14, 2019.


**Photo 3.6.1:** View of condor chick #980 fledging live from the cross-canyon camera, as seen by viewers on the Cornell bird camera website's YouTube stream. *Photo credit: USFWS.*

During the nearly five months that the camera was online, it was viewed over 400,000 times from 72 countries and watched for 2.2 million minutes (4 years and 2 months). This was an 83% increase in minutes viewed compared to 2018.

*CondorKids Third Grade*

The CondorKids third grade curriculum was again used by the Fillmore Unified School District during the 2018 - 2019 school year. All 12 third grade classes participated, reaching over 300 students. Members of the field team from the Complex and SBZ visited schools to share 1-hour presentations about California condors and conservation careers. Each of the four Fillmore elementary schools had a team member attend their open house night events. The USFWS Park Ranger visited each of the 12 classes twice to share a presentation on California condors and lead an art project. To complete the curriculum, students and teachers took a field trip to the Santa Barbara Zoo over the course of two days. Each day, 150 students were able to view condors on

exhibit and interact with many of the field team members. Four condor related activities, led by SBZ and Complex staff, were offered to the students who participated: rock climbing, radio telemetry, using scopes and binoculars, and condor bio-facts (Photo 3.6.2).

**Photo 3.6.2:** Third grade CondorKids learn about California condor nests and climb a simulated rock wall during a field trip to Santa Barbara Zoo, Santa Barbara, California. *Photo Credit: Daniel Cook, USFWS.*

### *CondorKids Seventh Grade*

For the first time, a middle school curriculum was developed in partnership with the SBZ and Ventura County educators, then piloted in the CondorKids program. One hundred fifty seventh grade students at Fillmore Middle School participated in the pilot program in class with their science teacher Laurie Merrill. Isbell Middle School, in the neighboring city of Santa Paula, had an after-school program using portions of the third and seventh grade curriculum, adapted by science teacher Cindy Martin, with 50 participants. The USFWS Park Ranger visited both schools to help prepare students for the culmination of their study with a field experience at Bitter Creek NWR. Each day, for two days, 50 students took buses chartered by the FCCWF to participate in archery, hiking, condor work-ups with releases, and radio telemetry to track condors in the wild (Photo 3.6.3). Over 20 conservation professionals and volunteers from our partnerships assisted in the instruction and facilitation each day. The participating teachers continued to help develop curriculum through the summer and piloting in September.

**Photo 3.6.3:** Seventh grade CondorKids learn about California condor conservation and observe an examination of a California condor before it is re-released to the wild at Bitter Creek NWR, Kern County, California. *Photo Credit: Daniel Cook, USFWS.*

*Non-Lead Outreach*

The IWS Non-lead Outreach Coordinator for Southern California was involved in 66 outreach activities, directly reaching 3,455 people in and around Southern California. These activities included a podcast interview, information booths, presentations to hunting and conservation groups, shoot participation events, and shooting demonstrations (Photo 3.6.3, Table 3.6.1). Topics included non-lead ammunition performance, ammunition ballistic performance, the role of hunting in conservation, current state hunting laws, and the effects of lead on condors and other wildlife. During shoot participation events, the audience was able to use their own firearms and compare lead and non-lead ballistics. Demonstrations were conducted by the IWS staff shooting lead and non-lead bullets into a capture system that allows participants to see the characteristics of each ammunition type. The IWS also manages and updates content for a Hunting with Non-lead Facebook page and the website huntingwithnonlead.org.

**Photo 3.6.3:** Shooting demonstration at Bitter Creek NWR. *Photo credit: Chad Thomas, IWS*

*Preventing Habituation*

Outreach activities were the primary means of addressing behavioral modification in the Northern Tehachapi Mountain communities. The field team posted educational flyers at the BVS Police Department, Post Office, and Bear Valley Market. Flyers were electronically distributed via the BVS Community Services District website, Stallion Springs Community Services District website, and Alpine Forest Park Property Owner's Association website. Each community service district also provided flyers through community newsletters and sent them to residents by mail (Appendix II).

*Other Outreach Activities*

The field team responded to eight media outlet requests to provide information about various aspects of condor conservation. These media outlets included: local news media, a podcast, a documentary crew, and USFWS public affairs staff (Table 3.6.2).

The field team led and assisted with 38% more tours than in 2018, with 29 on Refuge tours and activities, bringing 461 visitors to the Refuge Complex. Two tours were at Guadalupe-Nipomo Dunes NWR, six tours were at Hopper Mountain NWR, and 21 tours were at Bitter Creek NWR (Table 3.6.3). The tour recipients included local Audubon chapters, a young birders club, secondary schools, colleges, summer youth programs, Youth Conservation Corps, potential partners in California condor recovery, and the general public. The FCCWF also assisted with many of the Refuge tours.

In addition to the non-lead outreach presentations, information about other condor recovery efforts was provided at 42 other off Refuge locations in 2019. This was an increase of 147% from 2018. These activities included presentations for schools, colleges, community events or fairs, online, and conservation groups. Combined on and off Refuge outreach efforts directly reached an estimate of 10,900 people (Table 3.6.4). The CondorKids Field Guide coloring book was published in January 2018 and over 10,000 copies were distributed to the public during various outreach events in 2019.

Field team members were also co-authors on two articles published in a scientific journal in 2019. The article titled: "Characteristics of feeding sites of California Condors (Gymnogyps californianus) in the human-dominated landscape of southern California" was published by *The Wilson Journal of Ornithology* (Hall et al., 2019) in October, and the article titled: "Applying circuit theory and landscape linkage maps to reintroduction planning for California Condors" (D'Elia et al., 2019) was published in PLOS One in December.

**Table 3.6.1:** Institute for Wildlife Studies Non-Lead ammunition outreach efforts in 2019.

| Event Description | Number of Events | Total Contacts |
|---|---|---|
| Media (Podcast) | 1 | 8 |
| Information Boot | 7 | 1742 |
| Hunting Organization Presentation | 39 | 1397 |
| Conservation Organization Presentation | 7 | 163 |
| Shoot Participation Event | 3 | 11 |
| Shooting Demonstration | 9 | 134 |
| Total | 66 | 3455 |

**Table 3.6.2:** Media outreach and contacts conducted by the field team during 2019.

| Description | Location | Date |
|---|---|---|
| Santa Clarita Valley Signal article: Condor cam captures development of newborn chick | Santa Clarita, CA | 5-Jun |
| San Luis Obispo Tribune article: Get a live look at endangered California Condor Chick nestled in Ventura County mountains | San Luis Obispo, CA | 6-Jun |
| Forbes article: Hello World! Watch A Wild Baby California Condor Grow Up Streaming Live | Online, Forbes.com | 6-Jun |
| edhat Santa Barbara article: Watch wild endangered California condor chick live on 'condor cam' | Santa Barbara, CA | 7-Jun |
| Santa Barbara Independent article: Meet the Condor Cam's New Stars | Santa Barbara, CA | 10-Jun |
| LA Times Article: How the California condor returned from the brink of extinction | Los Angeles, CA | 24-July |
| Legion DIY/CDFW/KUIU Live Podcast with IWS Non-lead Outreach Coordinator | Dixon, CA | 8-Sep |
| LA Times article: Where to see California condors in the wild | Los Angeles, CA | 9-Sep |

**Table 3.6.3:** California condor related on-Refuge tours and activities in 2019

| Description | Location | Date |
|---|---|---|
| Complex staff lead tour for California State University Channel Islands (CSUCI) art students; 4 participants | Bitter Creek NWR | 22-February |
| CSUCI art students work on mural; 3 participants | Bitter Creek NWR | 03-March – 05 March |
| FCCWF and complex staff lead refuge tour with a non-lead shooting demonstration from Chad Thomas of IWS; 24 participants | Bitter Creek NWR | 06-April |
| Complex staff lead Conejo Audubon Society tour; 27 Participants | Hopper Mountain NWR | 07-April |
| CSUCI art students work on mural; 3 participants | Bitter Creek NWR | 20-May – 23 May |
| FCCWF and complex staff lead refuge tour; 25 participants | Hopper Mountain NWR | 01-June |
| FCCWF and complex staff lead refuge tour; 24 participants | Hopper Mountain NWR | 15-June |
| Complex staff lead Kern Audubon Society tour; 23 participants | Bitter Creek NWR | 26-June |
| Complex staff lead field trip for Environmental Charter High School, AP Environmental Science Class; 15 participants | Bitter Creek NWR | 10-July |
| Complex staff and National Wildlife Refuge Association representative Angie Horn host Kern Youth Conservation Corps at condor work-up; 10 participants | Bitter Creek NWR | 16-July |
| Complex staff host Kat Selm of The Nature Conservancy for a work-up and tour | Bitter Creek NWR | 23-July |
| Complex staff lead FCCWF volunteer work day; 8 volunteers | Bitter Creek NWR | 27-July |
| Complex staff and Santa Barbara Zoo education coordinator host CondorKids curriculum and planning with Fillmore Middle School and Isbell Middle School teachers; 3 participants | Hopper Mountain NWR | 31-July |
| Complex staff and Ray Lamotta host Dunes Center tour to Lunar Craters; 14 participants | Guadalupe-Nipomo Dunes NWR | 11-August |
| Complex staff lead tour and meeting for Hi Mountain and the U.S. Forest Service; 4 participants | Bitter Creek NWR | 19-August |
| Complex staff lead volunteer work day; 5 participants | Guadalupe-Nipomo Dunes NWR | 24-August |
| Complex staff and FCCWF lead refuge tour; 22 participants | Hopper Mountain NWR | 14-September |
| Complex staff lead National Public Lands Day volunteer work event and tour; 12 participants | Bitter Creek NWR | 28-September |
| Complex staff and FCCWF lead refuge tour; 21 participants | Hopper Mountain NWR | 05-October |
| Complex staff lead Los Angeles Audubon Society tour; 26 participants | Bitter Creek NWR | 26-October |

| | | |
|---|---|---|
| Complex staff and FCCWF lead refuge tour; 26 participants | Hopper Mountain NWR | 09-November |
| Complex staff and 12 volunteers host Fillmore Middle School tour; 62 participants | Bitter Creek NWR | 19-November |
| Complex staff host Ventura 4H volunteer work event; 12 participants | Hopper Mountain NWR | 13-December-14-December |

**Table 3.6.4:** California condor related off-refuge outreach activities performed in 2019.

| Description | Location | Date |
|---|---|---|
| Complex staff present to Isbell Middle School Special Education Class; 22 participants | Santa Paula, CA | 06-February |
| Complex staff and FCCWF hosts trash clean up off of Ridge Route Road; 5 participants | Castaic, CA | 23-February |
| Complex staff read The Condor's Egg for National Reading Day at Vineland Elementary School; 120 participants (third and fourth grade students) | Bakersfield, CA | 01-March |
| Complex staff and FCCWF table at Wind Wolves Preserve Spring Nature Festival; 2,000+ in attendance; 500+ participants | Bakersfield, CA | 15-March |
| Complex and Ventura U.S. Fish and Wildlife Office staff table at California Lutheran University STEM Expo; 150 participants | Thousand Oaks, CA | 22-March |
| Complex staff present to CSUCI for Principals of Resource Management class; 35 participants | Camarillo, CA | 28-March |
| Complex staff present to San Cayetano Elementary School; 66 participants | Fillmore, CA | 29-March |
| Complex staff and FCCWF table at Los Angeles Zoo Spring Fling; 1,000+ participants | Los Angeles, CA | 30-March |
| Complex staff table at Los Angeles Zoo Spring Fling; 1,000+ participants | Los Angeles, CA | 31-March |
| Complex staff present to Piru Elementary School; 41 participants | Fillmore, CA | 04-April |
| Complex staff present to Mountain Vista Elementary School; 116 participants | Fillmore, CA | 10-April |
| Complex staff present to Rio Vista Elementary School; 77 participants | Fillmore, CA | 12-April |
| Complex staff table at Los Angeles Zoo Spring Fling; 1,000+ participants | Los Angeles, CA | 13-April – 14-April |
| Complex staff present to San Cayetano Elementary; 66 participants | Fillmore, CA | 16-April |
| Complex staff and volunteer table at Los Angeles Zoo Spring Fling; 1,000+ participants | Los Angeles, CA | 20-April – 21-April |
| Complex staff, Ventura U.S. Fish and Wildlife Office staff, and 3 Fillmore Middle School students table at Fillmore Earth Day; 350 participants | Fillmore, CA | 22-April |
| Complex staff present to Rio Vista Elementary; 77 participants | Fillmore, CA | 23-April |
| Complex staff present to Piru Elementary; 41 participants | Fillmore, CA | 23-April |
| Complex staff lead CondorKids art projects at San Cayetano Elementary School; 66 participants | Fillmore, CA | 25-April |
| Complex staff lead CondorKids art projects at Rio Vista Elementary School; 77 participants | Fillmore, CA | 26-April |
| Complex staff present to Mountain Vista Elementary; 116 participants | Fillmore, CA | 30-April |

| | | |
|---|---|---|
| Complex staff lead CondorKids art projects at Mountain Vista Elementary School; 116 participants | Fillmore, CA | 01-May |
| Field team attend Fillmore Elementary School Open Houses; +600 participants | Fillmore, CA | 02-May |
| Complex staff lead CondorKids art projects at Mountain Vista Elementary School; 41 participants | Fillmore, CA | 03-May |
| Complex staff present to Kern Audubon Society; 50 participants | Bakersfield, CA | 07-May |
| Complex staff present to seventh grade science and two Special Education classes at Isbell Middle School; 450 participants | Santa Paula, CA | 09-May |
| Complex staff host seventh grade CondorKids After School Club at Isbell Middle School; 40 participants | Santa Paula, CA | 09-May |
| Complex staff present to University of California, Santa Barbara Endangered Species class; 40 participants | Santa Barbara, CA | 13-May |
| Complex staff host seventh grade CondorKids After School Club at Isbell Middle School; 45 participants | Santa Paula, CA | 16-May |
| Complex staff lead birding activities at Science and Outdoor Recreation Day with Fillmore Middle School at Sheills Park; 300 in attendance, 30 participants | Fillmore, CA | 22-May |
| Complex staff host seventh grade CondorKids After School Club at Isbell Middle School; 50 participants | Santa Paula, CA | 23-May |
| Complex staff lead creative writing workshop for K-12 students at Fillmore Unified School District Parent Engagement Night; 100 parents in attendance, 24 student participants | Fillmore, CA | 23-May |
| Field staff host third grade CondorKids SB Zoo Field trip; 160 participants | Santa Barbara, CA | 28-May – 29-May |
| Complex staff and 5 Pasadena Young Birders table at Eaton Canyon; 22 participants | Los Angeles, CA | 16-June |
| Complex staff present to Ventura Bird Club; 20 participants | Ventura, CA | 29-August |
| Complex staff work with Fillmore area seventh grade teachers to develop CondorKids curriculum; 2 participants | Fillmore, CA | 31-August |
| Complex staff work with Fillmore area seventh grade teachers to develop CondorKids curriculum; 2 participants | Fillmore, CA | 07-September |
| Complex staff lead birding activity for Fillmore Middle School seventh grade CondorKids Outdoor Recreation field trip at Sespe Creek and Sheills Park; 300 participants | Fillmore, CA | 27-September |
| Complex staff table at Alan Hancock College Career Fair; 2,000 high school students in attendance | Santa Maria, CA | 04-October |
| Complex staff and Ventura U.S. Fish and Wildlife Office staff table at Oxnard College Career Fair | Oxnard, CA | 15-October |
| Complex staff table and participate in panel discussion at Tulare County Office of Education's Next Generation Science Standards Rollout #6; 143 participants | Tulare, CA | 29-October |
| Complex staff present to Kamala School (elementary); 32 participants | Oxnard, CA | 30-October |

| | | |
|---|---|---|
| Complex staff table and participate in panel discussion at Ventura County Office of Education's Next Generation Science Standards Rollout #6 | Camarillo, CA | 06-Nov |
| Complex staff present to Fillmore Middle School; 150 participants | Fillmore, CA | 08-Nov |
| Complex staff present to Fillmore Middle School; 150 participants | Fillmore, CA | 15-Nov |
| Complex staff present to Cuyama Valley High School; 50 participants | New Cuyama, CA | 26-Nov |
| Complex staff present to Parkview Elementary Environmental Projects class (after school); 20 participants | Pt. Hueneme, CA | 11-Dec |
| Complex staff table and present to Ventura County Office of Education's Community Based Partners Meeting | Camarillo, CA | 19-Dec |

# 4.0 Discussion

*Monitoring Resource Use*

The field team continued to maintain a high number of GPS deployments, with 83 birds wearing units at the end of the year. With the majority of condors now wearing GPS transmitters providing location data, the use of daily VHF radio telemetry has been adapted to primarily serve as a tool for detecting mortalities. Radio telemetry is still an important tool for the field team for tracking birds without GPS transmitters and determining whether birds are sick or dead; thus, it is imperative to maintain working VHF transmitters on condors even if they have GPS units.

The increase in the number of GPS transmitters attached to condors has meant the field team has needed to dedicate more time inspecting location data from these transmitters on a regular basis. The field team would greatly benefit from having a dedicated data manager/GIS position to aid in more effectively using this new source of information. Additionally, as condors in the Southern California population expand their wild range, the field team will require more personnel to cover additional office and field monitoring of the birds.

*Lead Monitoring and Mitigation*

Lead toxicosis continues to be the leading cause of mortality in free-flying condors, and was found to be the cause of death in 50% of the 185 condors where the cause of death has been determined. In order for the California condor to fully recover as a species, the transition of firearms enthusiasts use of lead ammunition and to non-lead options must occur to address this major threat to the condor's survival.

With the full implementation of AB711 this year, outreach and support will be a necessary factor in helping hunters, ranchers, and others to make the transition to non-lead ammunition. Currently, the IWS Non-lead Outreach Coordinator for Southern California is the primary individual conducting outreach and offering assistance to the public. However, as the range of the condor continues to expand, and with the full implementation of the new laws, having additional individuals to aid in this important effort could greatly impact the success of the population in years to come.

*Detecting Mortalities*

Radio telemetry using VHF transmitters is still an integral tool for the program in determining the location of sick or deceased condors. The primary benefits of using VHF transmitters had previously been to provide daily location data, presence/absence of individuals in the population, and monitoring which condors had gone missing for long periods of time and may be sick, injured, or dead. With the availability of lightweight GPS transmitters that provide highly detailed data that can be uploaded from almost anywhere, VHF transmitters have become most useful as a tool to help us locate birds in the field

after GPS data has already helped us to identify it as a bird of concern. GPS location data is generally uploaded every one to three days, and though it is extremely useful and provides far more information than VHF, it does not provide an instantaneous location. By pairing GPS and VHF monitoring techniques, the field team is able to quickly identify and locate birds of concern and respond accordingly with observations, captures, or recoveries of the birds.

As has been the trend in recent years, we continue to see more instances in which we are able to identify sick, injured, and dead birds using this combination of GPS and VHF tools. This has helped contribute to our ability to get birds in for medical treatment, and to quickly recover carcasses to better understand the causes of mortality.

*Nest Management*

Condors continue to expand the area in which they establish nests, and new pairs are being created each year. In 2019, four of the seven pairs were nesting for the first time together, and one new territory was established since re-introduction. It is likely that nesting activity will extend beyond public lands in the future, which may affect the field team's ability to manage nests in the same way that we have.

In 2015, the field team adjusted protocol to reduce the intensity of our nest guarding program from what was established in 2007. As the wild condor population continues to grow, and as the number of nests increases, we will need to continue to look at the efficacy and impacts of our nest management actions and the resources we have available to make the best management decisions.

*Outreach*

This was the fourth year that the CondorKids program had dedicated staff to assist in implementing the program. A Park Ranger position funded under the Urban Refuges Program and filled by the Complex assists in scheduling classroom visits, planning tours, and works to expand the curriculum into new schools and classrooms. This position will greatly expand the success of the CondorKids program and continues to assist in the development of new materials to reach a greater audience.

# Works Cited


Bakker, V.J., Smith, D.R., Copeland, H., Brandt J., Wolstenholme, R., Burnett, J., Kirkland, S., and. Finkelstein, M.E. 2017 Effects of Lead Exposure, Flock Behavior, and Management Actions on the Survival of California Condors (Gymnogyps californianus). EcoHealth Vol. 14: Pp. 92. https://doi.org/10.1007/s10393-015-1096-2

Bukowinski, A.T., Bercovitch, F.B., Alberts, A.C., Wallace, M.P., Mace, M.E., and Ancona, S. 2007. A Quantitative Assessment of the California Condor Mentoring Program. Pp. 197-211 in A. Mee and L.S. Hall (eds.), California condors in the 21st century. Nuttall Ornithological Club Series in Ornithology No. 2. Nuttall Ornithological Club, Cambridge, MA, and American Ornithologists' Union, Washington, D.C.

Burnett, L.J., Sorenson K.J., Brandt J., Sandhaus E.A., Ciani D., Clark M., David C., Theule J., Kasielki S. and R.W. Risebrough. 2013. Eggshell Thinning and Depressed Hatching Success of California Condors Reintroduced to Central California. Condor Vol. 115(3): Pp. 477-491.

Cade, T.J., Osborn S.A.H., Hunt W.G., and Woods C.P. 2004. Commentary on released California condors Gymnogyps californianus in Arizona. Pp. 11-25 in R.D. Chancellor and B.-U. Meyburg, [eds.]. Raptors Worldwide. World Working Group on Birds of Prey and Owls/MME-Birdlife, Budapest, Hungary.

Cade, T.J. 2007. Exposure of California condors to lead from spent ammunition. Journal of Wildlife Management Vol. 71: Pp. 2125-2133.

Clark, M., Wallace M., and David C. 2007. Rearing California condors for release using a modified puppet-rearing technique. Pp. 213-226 in A. Mee and L.S. Hall (eds.), California condors in the 21st century. Nuttall Ornithological Club Series in Ornithology no. 2. Nuttall Ornithological Club, Cambridge, MA, and American Ornithologists' Union, Washington, D.C.

Cogan, C. B., D'Elia J, Convery K., Brandt J., and Bulgerin T. 2012. Analysis of California condor (*Gymnogyps californianus*) activity using satellite telemetry data. The Open Ornithology Journal Vol. 5: Pp82-93.

D'Elia, J., Brandt, J., Burnett, L.J., Haig, S.M., Hollenbeck, J., Kirkland, S., Marcot, B.G., Punzalan, A., West, C.J., Williams-Claussen, T. and Wolstenholme, R., 2019. Applying circuit theory and landscape linkage maps to reintroduction planning for California Condors. PLoS ONE 14(12): e0226491.

Diffendorfer, J.E., Compton R.W., Kramer L.A., Ancona Z.H., and Norton D. 2015. Onshore industrial wind turbine locations for the United States to March 2014: U.S. Geological Survey data release, https://doi.org/10.5066/F7251G8Q.

Emslie, S.D. 1987. Age and diet of fossil California condors in Grand Canyon, Arizona. Science Vol. 237: Pp768-770.

Finkelstein M.E., Doak D.F., George D., Burnett J., Brandt J., Church M., Grantham J., and Smith D. 2012. Lead poisoning and the deceptive recovery of the critically endangered California condor. Proceedings of the National Academy of Sciences Vol. 109(28): Pp.11449-11454.

Fry D.M and Maurer J. 2003. Assessment of lead contamination sources exposing California condors. California Department of Fish and Game: Species Conservation and Recovery Program Report. 2003-02.

Grantham, J. 2007. Reintroduction of California condors into their historic range: the recovery program in Southern California. Pp. 123-138 in A. Mee and L.S. Hall (eds.), California condors in the 21st century. Nuttall Ornithological Club Series in Ornithology no. 2. Nuttall Ornithological Club, Cambridge, MA, and American Ornithologists' Union, Washington, D.C.

Hall, J. C., Braham, M. A., Nolan, L. A., Conley, J., Brandt, J., Mendenhall, L., Lanzone, M., McGann, A., and Katzner, T. E. 2019. Characteristics of feeding sites of California condors (Gymnogyps californianus) in the human-dominated landscape of southern California. Wilson Journal of Ornithology 131:459–471.

Johnson C, T. Kelly, M. E. Finkelstein, D. Smith. 2013. Monitoring Post-ban Lead Exposure in the California Condor (Gymnogyps californianus). California Department of Fish and Wildlife Final Report Agreement P1082005-01.

Kelly, T.R., Grantham J., George D., Welch A., Brandt J., Burnett L. J., Sorenson K., Johnson M., Poppenga R., Moen D., Rasico J., Rivers J., Battistone C., and Johnson C. K. 2014. Spatiotemporal Patterns and Risk Factors for Lead Exposure in Endangered California Condors during 15 Years of Reintroduction. Conservation Biology. Pp. 13-845.R1.

Kelly, T. R., Rideout B. A., Grantham J., Brandt J., Burnett L. J., Sorenson K. J., and Johnson C. K. 2015. Two decades of cumulative impacts to survivorship of endangered California condors in California. Biological Conservation, Vol. 191: Pp391-399. DOI: 10.1016/j.biocon.2015.07.012

Kenward, R.E. 1978. Radio transmitters tail-mounted on hawks. Ornis Scand. Vol. 9: Pp. 220-223.

Lindsey, G. D. 1992. Nest guarding from observation blinds: strategy for improving Puerto Rican parrot nest success. Journal of Field Ornithology. Vol 63: Pp. 466-472

Lowney. M. S. 1999. Damage by Black and Turkey Vultures in Virginia, 1990-1996 Wildlife Society Bulletin, Vol. 27(3), Pp. 715-719

Mee, A., Hamber J.A., and Sinclair J. 2007. Low nest success in a reintroduced population of California condors. Pp. 163-184. in A. Mee and L.S. Hall [eds.]. California condors in the 21st Century. Nuttall Ornithological Club, Cambridge, MA, and American Ornithologists' Union, Washington, DC.

Poessel, S. A., Brandt, J., Miller, T. A. and Katzner, T. E. 2018a, Meteorological and environmental variables affect flight behavior and decision-making of an obligate soaring bird, the California Condor Gymnogyps californianus. Ibis, Vol. 160: Pp. 36-53. doi:10.1111/ibi.12531

Poessel, S. A., Brandt, J., Uyeda, L., Astell, M. and Katzner, T. E. 2018b, Lack of observed movement response to lead exposure of California condors. Journal of Wildlife Management Vol. 82: Pp. 310-318. doi:10.1002/jwmg.21378

Poessel, S.A., Brandt, J., Mendenhall, L., Braham, M.A., Lanzone, M.J., T. E. 2018c, Flight response to spatial and temporal correlates informs risk from wind turbines to the California Condor. Condor: Ornithological Applications Vol. 120: Pp 330–342.

Ralls, K. and Ballou J. 2004. Genetic status and management of the California condors. Condor Vol. 106: Pp. 215-228.

Rideout B.A., Stalis I., Papendick R., Pessier A., Puschner B., Finkelstein M.E., Smith D.R., Johnson M., Mace M., Stroud R., Brandt J., Burnett J., Parish C., Petterson J., Witte C., Stringfield C., Orr K., Zuba J., Wallace M., and Grantham J.. 2012. Patterns of mortality in free-ranging California condors (*Gymnogyps californianus*). Journal of Wildlife Diseases Vol. 48: Pp. 95-112.

Ridley-Tree Condor Preservation Act. 2008. In Assembly Bill No. 821. California State Assembly, Sacramento, CA. Available at http://www.leginfo.ca.gov/bilinfo.html.

Rivers J.W., M. Johnson, S.M. Haig, C.J. Schwarz, L.J. Burnett, J. Brandt , D. George, J. Grantham. 2014 An analysis of monthly home range size in the critically endangered California condor. Bird Conservation International 24.

Smith D. and Strupp BJ. 2013. The scientific basis for chelation: animal studies and lead chelation. Journal of Medical Toxicology. Vol. 9(4): Pp. 326-38. doi: 10.1007/s13181-013-0339-2.

Snyder, N.F.R. 2007. Limiting factors for wild California condors. Pp 9-33. in A. Mee and L.S. Hall (eds.), California condors in the 21st century. Nuttall Ornithological Club Series in Ornithology no. 2. Nuttall Ornithological Club, Cambridge, MA, and American Ornithologists' Union, Washington, D.C.

Snyder, N.F.R and J.A. Hamber. 1985. Replacement-clutching and annual nesting of California condors. Condor Vol. 87: Pp. 374-378.

Snyder, N.F.R, R.R.Ramey, and F.C. Sibley. 1986. Nest-site biology of the California condor. Condor Vol.88: Pp. 228-241.

U.S. Fish and Wildlife Service (Service). 1979. California Condor Recovery Plan, first revision. USFWS, Pacific Region, Portland, Oregon.

U.S. Fish and Wildlife Service (Service). 1996. California Condor Recovery Plan, Third Revision. Portland, Oregon.

U.S. Fish and Wildlife Service (Service). 2013. California Condor (Gymnogyps californianus) 5-Year Review: Summary and Evaluation. Sacramento, California.

U.S. Fish and Wildlife Service (Service). 2019. California Condor Recovery Program 2017 Annual Report. Ventura, California.

Wallace, M.P, Fuller M.R., and Wiley J. 1994. Patagial transmitters for large vultures and condors. Pp. 381-387 in B.U. Meyerburg and R.D. Chancellor, editors. Raptor conservation today. Pica Press, East Sussex, United Kingdom.

# Appendix I: Contributions to Ongoing Research

Field, laboratory, and telemetry data collected on the Southern California condor population over the course of 2019 significantly contributes to ongoing research conducted by the Service or in conjunction with various universities, federal, state and local agencies, and private organizations and individuals. Examples of this ongoing research in 2019 include:

**Genetic map and whole genome sequences of California condors**
**Years**: 2006-present

**Study Objective**: Utilize robust genetic and genomic approaches, construct a complete genome-based database of genetic variation in California condors, and make findings available for population management and recovery. Anticipated findings include: detailed analysis of kinship among founder California condors, detailed characterization of variation at the single nucleotide polymorphism (SNP) level, assessment of retention of genetic variation in the species pedigree, identification of the mutation causing chondrodystrophy, identification of carriers of chondrodystrophy allele.

**Principal Researchers**: Oliver A. Ryder from San Diego Zoo Global, Stephan C. Schuster from Nanyang Technological University, Singapore, Webb Miller from Pennsylvania State University, Center for Comparative Genomics and Bioinformatics, Michael Romanov from University of Kent, Canterbury School of Biosciences.

**Results to Date**: A genetic map for California condors based on comparison to chicken and zebra finch genomes has been published. A microsatellite-based linkage map is in development. Sequencing of 30 California condor genomes utilizing Illumina technology has been proposed and funding is pending. This study would identify all extant genetic variation at the nucleotide level and affords the opportunity to identify the mutation associated with heritable chondrodystrophy.

**Anticipated Completion**: If current funding proposals are approved, the reference genome and initial descriptions of species variation would be completed within one year. More detailed analyses of demography and evolutionary population genetics would follow. Priority will be given to reporting recovery-relevant findings.

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**An assessment of the biological impact of contaminants and management actions that influence the long-term persistence of the California condor**
**Years**: 2011-2020

**Study Objectives:** Synthesize existing data and collect new data on the risks of contaminant exposure to California condors. We will also identify the suitability of existing and proposed future habitat with respect to changes in contaminant exposure, human demographics, and climate. Quantify baseline measures of individual condor performance (e.g., survival,

reproductive success) and how these rates are influenced by the effects of contaminants (e.g., lead, organochlorines, microtrash) and future habitat suitability from changes in human demographics, climate. Develop demographic modeling approaches for each condor population in California that allows estimation of how contaminants, global climate change, future habitat suitability, and management efforts will impact population recovery.

**Principal Researchers**: Donald R. Smith and Myra Finkelstein from University of California, Santa Cruz. Daniel F. Doak from University of Colorado, Boulder, Vickie Bakker from Montana State University.

**Sponsors**: Department of Environmental Toxicology University of California, Santa Cruz; U.S. Fish & Wildlife Service, Hopper Mountain National Wildlife Refuge Complex, National Park Service, Pinnacles National Monument; US Geological Survey, Forest and Rangeland Ecosystem Science Center; U.S. Fish & Wildlife Service Water Pollution Control Laboratory CA Dept. of Fish and Game, Office of Spill Prevention and Response; University of Wyoming, USFWS Ventura Ecological Service Office

**Funding Sources**: Montrose Settlement Restoration Funds, USFWS Environmental Contaminants Program On-Refuge Investigations Sub-Activity

**Anticipated Completion**: 2020

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**Eggshell thinning and depressed hatching success of California condors reintroduced to Central California.**
**Years**: 2006-2019

**Study Objective**: Compare condor hatching success and eggshell thickness between reintroduced populations of California condors in Central and Southern California. Evaluate the cause of egg failure in wild laid eggs and assess the potential sources of organochlorine contamination and determine its impact of the condor population in Central California.

**Principal Researchers**: Joe Burnett and Kelly Sorenson from the Ventana Wildlife Society, Joseph Brandt from U.S. Fish & Wildlife Service Hopper Mountain National Wildlife Refuge Complex, Bob Risebrough from the Bodega Bay Institute.

**Sponsors**: Ventana Wildlife Society, U.S. Fish & Wildlife Service Hopper Mountain National Wildlife Refuge Complex, the Bodega Bay Institute, Los Angeles Zoo and Botanical Gardens, Santa Barbara Zoo.

**Funding Source**: Ventana Wildlife Society and USFWS Hopper Mountain NWRC

**Results to date**: Burnett et al., 2009 (presentation); Burnett, L. Joseph, Kelly J. Sorenson, Joseph Brandt, Estelle A. Sandhaus, Deborah Ciani, Michael Clark, Chandra David, Jenny Schmidt, Susie

Kasielke, and Robert W. Risebrough. 2013. Eggshell Thinning and Depressed Hatching Success of California Condors Reintroduced to Central California. The Condor 115 (3), 477-491

**Anticipated Completion**: 2020

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**California condor Nest Guarding Project**
**Years**: 2007- present

**Study objective**: Analysis of nest success in Southern California's reintroduced population of California condors along with the trends of breeding effort and nest success within this population in response to changes in foraging, demographics, and management strategy (tentative plan).

**Principal Researchers**: Estelle Sandhaus from the Santa Barbara Zoo and Joseph Brandt from the U.S. Fish & Wildlife Service Hopper Mountain National Wildlife Refuge Complex.

**Sponsors**: Santa Barbara Zoo; U.S. Fish & Wildlife Service Hopper Mountain NWRC; Los Angeles Zoo.

**Funding Source**: U.S. Fish & Wildlife Service Hopper Mountain NWRC and Sana Barbara Zoo.

**Results to date**: 6% Nesting Success (2001-2006) increased to 60% nesting Success (2006-2011), Brandt et al., 2008 (presentation), Brandt et al., 2010 (poster), Sandhaus et al. (2012) Wynn & Stringfield 2011.

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**Use of accelerometry data to interpret California condor behavior**
**Years**: 2017-2021

**Study objective**: Develop statistical models that interpret accelerometry data to describe behavior of wild California condors, especially as related to fire frequency, and model associations of behavior with landscape features. Data are collected by patagial tags specifically manufactured and designed for this project. We expect to use these models to develop ethograms for condors. Association of behaviors with landscape features will allow us to understand and predict places where risk to condors may be especially high.

**Principal Researchers**: Jonathan Hall and Darren Gross from West Virginia University, Todd Katzner from US Geologic Survey, Maitreyi Sur and Melissa Braham from Conservation Science Global, Inc.

**Funding Source**: National Fish and Wildlife Foundation

**Results to date**: We are now able to use accelerometer data from GPS/GSM telemetry units to identify specific behaviors of free-flying condors, a significant advancement in the field of wildlife telemetry and conservation. Additionally, we have a clearer overall picture of the behavioral and landscape patterns of condors' presence within Los Padres that we believe will aid landscape management, particularly as it relates to wildfires.

**Anticipated Completion**: 2021

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**Predicting Condor Range Expansion to Reduce Development Threats**
**Years:** 2017-present

**Principal Researchers**: Arianna Punzalan, Randall Boone Organization: Colorado State University

**Results to date**: We estimated annual core and home range areas of 123 condors that wore GPS units between the years of 2006 – 2017 and identified individual characteristics, management factors, population changes, and environmental variables associated with home ranges. We found that age group, time spent in the wild, age of managing agency, slope, NDVI, distance to water, and road density are all significant predictors of home range area. Using the associated factors, we built a tool to predict condor range expansion in suitable habitat in California, then identified likely areas of conflict between predicted range expansion and potential wind energy development. More than 85% of commercially valuable wind was unaffected by predicted home range areas, suggesting there are many alternative sites to develop. We found that <5% of predicted range overlapped with commercially valuable wind, however overlapping areas coincide with the most recent core areas estimated during our study.

**Anticipated Completion**: 2020

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**Screening Condor Feces for lead and copper with XRF**
**Years:** 2017-present

**Study objective**: XRF (X-ray Fluorescence) represents a non-invasive method to gain insight on lead and copper exposure in condors. Only a small number of samples from wild condors, zoo condors and two condors undergoing lead remediation therapy have been analyzed. The feces samples are aggregated for a given population and the only individual feces samples are from the two condors undergoing lead remediation therapy.

**Principal Researchers**: Steven Bachofer

**Funding Source**: Saint Mary's College of California

**Results to date**: Preliminary XRF results indicate lead is observable in the condors undergoing therapy and appears below the detection limit in wild condors that are healthy. The copper levels are measurable in nearly all the samples and can be elevated.

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**Assessing marine endocrine disrupting compounds in the critically endangered California condor: implications for reintroduction to coastal environments**
**Years:** 2018-present

**Study objective**: This project screens for environmental organic contaminants in coastal and non-coastal California condors from populations within California. The research uses a novel non-targeted chemical analysis to identify compounds, and then determines their endocrine disrupting potential via in vitro hormone receptor assays. The project aims to establish if the primary source of these compounds is from the coastal condors' consumption of marine mammal carcasses. Marine mammal contaminant loads will be compared between populations from the upper Gulf of California and the Southern California Bight to understand any difference in contaminant profiles. Overall, the project will assess the risk of reintroducing California condors to the coastal regions of Baja California by measuring endocrine disrupting chemicals in marine mammals from the upper Gulf of California.

**Principal Researchers**: Dr. Eunha Hoh, Dr. Nathan Dodder, Maggie Stack (San Diego State University); Dr. Christopher Tubbs, Dr. Ignacio Vilchis (San Diego Zoo Institute to Conservation Research)

**Funding Source**: California Sea Grant

**Anticipated Completion**: 2021

## Appendix II: Flyers provided to residents where condor habituation is a concern.

# CALIFORNIA CONDORS OBSERVED NEARBY

**An unforeseen hurdle in the reintroduction of California condors is undesirable behaviors related to condors coming into close proximity with human structures and humans. Residential areas and other development (e.g. power poles or antennae arrays) have caused serious injury to condors. Condors can ingest small items around homes and feed them to their chicks; this can cause starvation, stunted growth, and death. Condors that come in close proximity to humans are also at risk of becoming "habituated" resulting in subsequent removal from the wild. In addition to the risks to condors, there is also a high potential for property damage due to condors' curious nature and sharp, powerful beaks.**

**Condors can engage in these behaviors for a variety of reasons, including attraction to nearby food or water sources or use of structures in close proximity to roosting habitat. The landscape in your area contains habitat conducive to condor foraging and roosting. Condors have historically used this area and have recolonized the area since their release back into the wild.**

**Please assist us in keeping condors and residents' property out of harm's way.**

## IF YOU SEE A CONDOR:

- **Record wing tag # and color whenever possible**
- **Do not approach or feed condors**
- **Contact the USFWS California Condor Recovery Program at (805) 644-5185**
-

**California condors are an endangered species and are protected by state and federal law. HOWEVER, that does not mean that residents are helpless in trying to keep condors from perching on their homes and causing damage. It simply means that no one is permitted to harm or kill California condors.**

***Please see backside of flyer for information on condor deterrents and actions.***

U.S. FISH & WILDLIFE SERVICE
DEPARTMENT OF THE INTERIOR

CALIFORNIA CONDOR RECOVERY PROGRAM

Friends of California Condors Wild and Free

**EFFECTIVE CONDOR DETERRENTS AND ACTIONS:**

- **Scarecrow motion-activated animal deterrent (most effective method available) (http://www.contech-inc.com/products/home-and-garden-products/animal-repellents/scarecrow-motion-activated-animal-deterrent)**
- **Removing attractants (e.g. open trash and recyclable containers, wires, seat cushions, drinkable water sources)**
- **Constructing barriers to vulnerable property that is not able to be moved (e.g. barriers to AC unit wires, metal conduit around exposed wires, protective caps around insulation on outside water spouts)**
- **Immediate response by homeowners in scaring visiting condors away (e.g. spraying water, owning outdoor dogs, yelling/clapping/loud noises)**

**UNTESTED DETERRENTS THAT MAY BE EFFECTIVE:**

- **Electric track/electric strip tape (http://www.birdbgone.com/products/electric-track.html ; http://www.birdbarrier.com/products/bird-shock-flex-track/ ; http://www.nixalite.com/shocktape.aspx)**
- **Avian Control Bird Repellent Spray (http://solveyourbirdproblems.com/)**
- **Rollers for deck railings and ledges (http://coyoteroller.com/)**
- **Avian anti-perching spikes (http://www.nixalite.com/Nixalitemodels.aspx#Premium_Model_S)**
- **Artificial effigies (http://www.hankenimports.com/artificial-animals/93-15-inch-artificial-heads-up-vulture.html)**
- **Gull sweep/daddi long legs (http://www.gullsweep.com/index.html ; http://www.birdbusters.com/pigeon_control_repellent.html)**

*** The following list does not imply endorsement of any of these products by the USFWS. It is simply a list of options.**

**U.S. Fish & Wildlife Service**

**California Condor Recovery Program**

**2493-A Portola Rd.**

**Ventura, CA 93003**

**(805) 644-5185**

# California Condor Recovery Program

The California condor (*Gymnogyps californianus*) is the largest land bird in North America with a wingspan of 9.5 feet and weighing up to 25 pounds. In 1967 the species was listed as "endangered" and in 1982, only 23 condors survived world-wide. By 1987, all remaining wild condors were captured and placed into a captive breeding program. In 1992, the U.S. Fish and Wildlife Service, along with its public and private partners, began reintroducing captive-bred condors to the wild. In 2008, the population reached an important milestone with more California condors living in the wild than in captivity. Today there are now over 450 birds in total with approximately 300 flying free throughout their current range.

The California Condor Recovery Program is a collaborative effort, led by the U.S. Fish and Wildlife Service. This recovery program is locally partnered with the Santa Barbara and Los Angeles Zoos, the Great Basin Institute, and the Institute for Wildlife Studies to monitor and grow the southern California population of roughly 90 individuals. Each year the wild condor flock grows with newly released juveniles and young produced in wild nests. This collaborative effort is working hard to recover the California condor for today and into the future.

# What can you do?

## *Threats to condors*

**Lead Poisoning:** Condors are scavengers and when feeding on lead-shot carrion can ingest lead fragments. This can be fatal to condors.

***You can help by:***

- Use non-lead bullets, such as copper*
- Support the hunting tradition and the transition into sustainable non-toxic ammunition alternatives in the field
- Report illegal shooting to the authorities

Learn about hunting with non-lead:
www.huntingwithnonlead.org

**Effective July 1, 2019, non-lead ammunition will be required when taking any wildlife with a firearm anywhere in California.*

**Microtrash:** Small bits of trash such as broken glass, bottle caps, and other broken down pieces of trash that can be ingested by condors. Since condors are curious, they are attracted to objects that stand out. When microtrash is brought to the nest it is often ingested by condor chicks, preventing the birds from digesting food, resulting in starvation and death.

***You can help by:***

- Not littering or dumping trash in condor habitat
- Practice leave no trace and pick up all trash

## *How to get involved*

**Friends of California Condors Wild and Free:**
This non-profit group organizes many tours in condor habitat and workdays (trash cleanup) where you can come out and get your hands dirty!

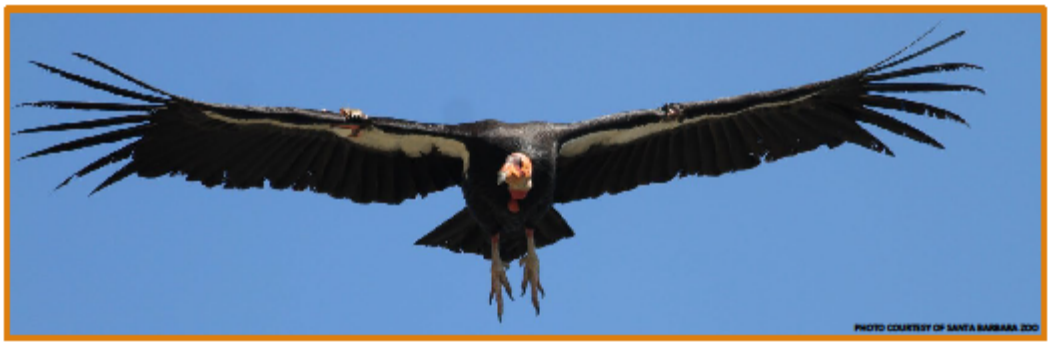
www.friendsofcondors.org/

**U.S. Fish and Wildlife and Santa Barbara Zoo:**
Volunteer to help the U.S. Fish and Wildlife Service and Santa Barbara Zoo staff monitor condor nests to protect the chicks in their first few months.

www.fws.gov/cno/es/calcondor/CondorVolunteerOpportunities.cfm

## WHAT TO DO IF YOU SEE A CALIFORNIA CONDOR

Help biologists keep track of your favorite birds by letting us know when you see a condor! Record the tag color and number as well as the time and location that you spotted the bird (drop a pin on your phone or GPS) then send us an email at hoppermountain@fws.gov. Pictures and videos are always welcome! You can also add your observations and pictures on the iNaturalist app or website.



*Is there a condor perched on your house, other personal property, or in your backyard?*

Condors are naturally inquisitive and can become habituated or behaviorally compromised through interactions with humans or human structures, which can lead to individual condors teaching these inappropriate behaviors to other condors. Help us implement measures to avoid and minimize the attraction of humans, trash and human structures to condors! This protects condors as well as your personal property.

Minimize the attraction of humans and human structures by:

- Flushing - use noise, clapping, and waving arms at condors to shoo them away
- Use perching deterrents such as sprinklers, spinning bird spider deterrents, and keep a clean yard
- Keeping areas frequented by condors free of attractants, such as trash and food resources
- Never feed or make friends with a condor, they are wild animals

## FOR MORE INFORMATION

U.S. Fish and Wildlife Service
California Condor Recovery Program
2493 Portola Road, Suite A
Ventura, California 93003
Phone: 805.644.5185
www.fws.gov/cno/es/calcondor/condor.cfm

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Friends of California Condors wild and Free