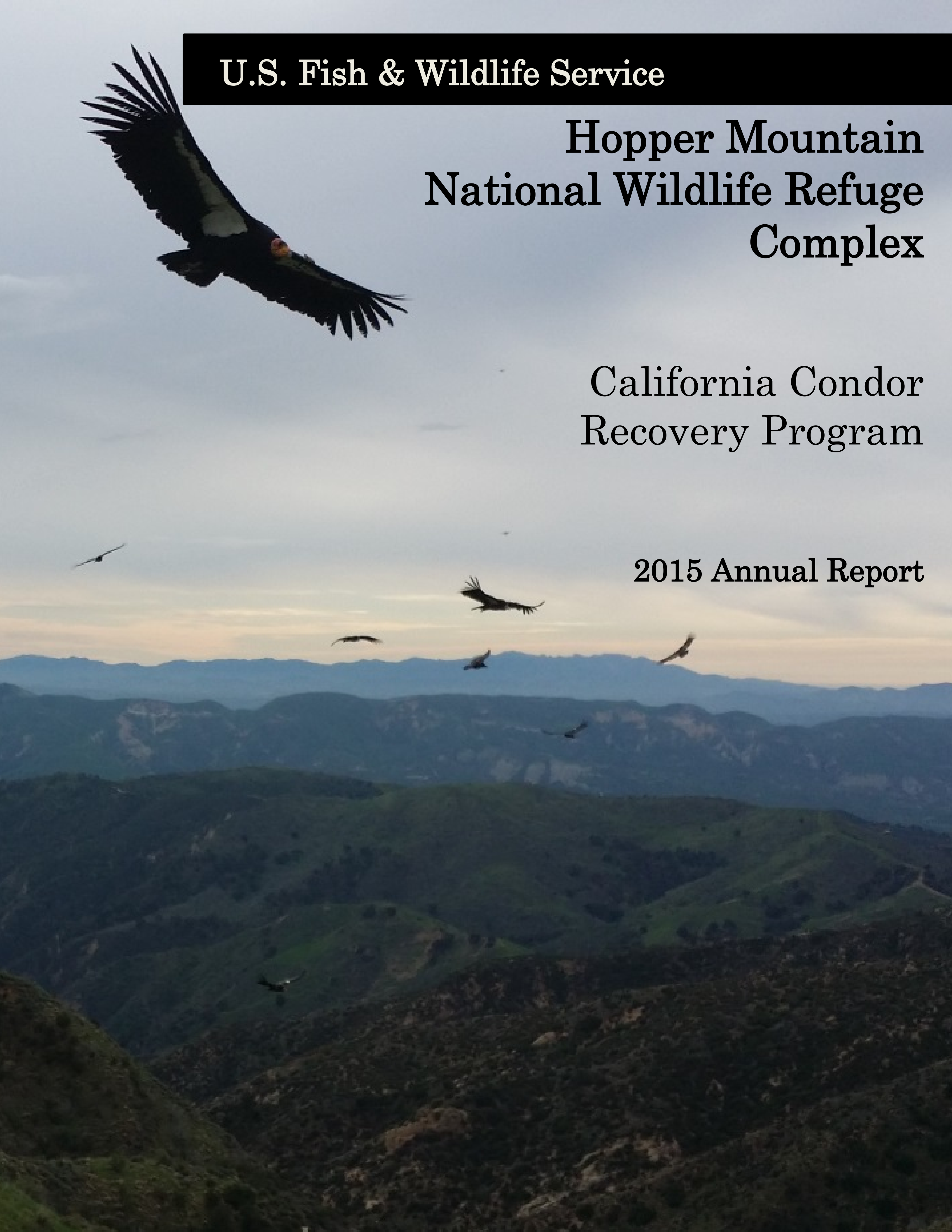
U.S. Fish & Wildlife Service

Hopper Mountain National Wildlife Refuge Complex

California Condor Recovery Program

2015 Annual Report



On the Cover: Eight condors soar over Tom's Canyon at Hopper Mountain NWR.
Photo Credit: Joseph Brandt, USFWS

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

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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.

As of December 31, 2015 the California condor population managed directly by the U.S. Fish and Wildlife Service (Service) consisted of 78 free flying condors. Five wild chicks fledged from ten nests in 2015. This was the highest number of nests recorded in the population since reintroduction. The field team decreased the level of nest management by reducing the number of entries performed at each nest. This was to accommodate the increased number of nests. Three of these nests were monitored using the remote nest cameras and required fewer nest entries due to the more detailed monitoring that the cameras provided. Ten captive reared condors were released at Bitter Creek National Wildlife Refuge in 2015 during the months of October, November, and December. In addition to these captive releases, a wild condor trapped in 1985 for captive breeding was rereleased into the wild in December of 2015. As a result of the successful wild nests and captive releases, the population increased by 18%.

The reintroduced condor population continues to recolonize its former range, exemplified by increased condor activity in the northern Tehachapi and southern Sierra Nevada Mountains. The increase in activity in the Tehachapi Mountains has also meant more condors within the footprint of wind energy facilities which is of concern.

The field team attempted to trap the population twice during the year to monitor for lead exposure which 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 more reliant on non-proffered food sources. This year 26 condors (39% of the population) evaded trapping in 2015. This becomes relevant for maintaining VHF and/or GPS transmitters on each condor and for monitoring and mitigating lead exposure. Lead exposures continue to occur in the population with nine condors (16%) requiring treatment for elevated blood lead levels in 2015.

Eight condors died and two were declared dead in 2015. One condor was a 17 year old breeding female that died of lead poisoning. A newly fledged condor is presumed dead after a telemetry mortality signal was detected for this condor. Four wild chicks died prior to fledging. One of these chicks died of lead poisoning, which is the first documented chick to die of lead. In addition to the 9 wild condors, a captive bred condor transported to Bitter Creek NWR died prior to its release due to an unknown illness.

Condors continued to inhabit the northern Tehachapi Mountains, where interactions with humans in the residential mountain communities of Bear Valley Springs, Stallion Springs and Alpine Forest Park occurred but to a lesser degree than previous years. This is likely the result of building a strong relationship with these communities and conducting targeted education and outreach for residents on how to discourage these types of interactions.

The Complex used partnerships to increase the level of condor education and outreach. The Service, in partnership with the Santa Barbara Zoo, continued showcasing condor nesting behavior and management on the the Condor Cave Facebook page. The Condor Cave has increased its following by 112% with a total of 4,584 followers as of December 31, 2015. One nest camera streamed live on the internet through a partnership with the Cornell Lab of Ornithology, the Santa Barbara Zoo, and Western Foundation of Vertebrate Zoology. Although this camera went live relatively late in the nesting season, it still managed to reach 57,000 unique viewers from 112 countries who watched for over 31,000 hours. The CondorKids program also started in 2015. This exciting new program brings condors into the classroom with curriculum developed by the Santa Barbara Zoo and the Service. Funding for CondorKids was obtained through the Urban Refuge Initiative. The new partnership with the Institute for Wildlife Studies also increased outreach focused on the use on non-lead ammunition. The non-lead outreach coordinator, based at the Complex's office in Ventura, conducted 12 events reaching close to 2,000 people. Other outreach activities included tours of each wildlife refuge, presentations to interest groups, elementary, high school, and college students, and interviews with media outlets including stories on National Public Radio and the Washington Post.

There were a number of staffing changes that occurred in 2015. The two Service wildlife biologist positions that were vacant at the end of 2014 were filled. The Santa Barbara Zoo created a new condor biologist position to assist with condor recovery field activities. The Service also filled the remaining vacant biological science technician with a new employee.

Southern California Population Highlights

Population Size

(as of December 31, 2015)

	Adults (≥6 years old)	Juveniles (<6 years old)	Total
Males	23	18	41
Females	17	20	37
Total	40	38	78

For more information on the change in population size see Figure 3.5.1 on page 42

Nesting

	Successful Nests	Failed Nests	Total
Nests in 2015	5	5	10
All Nests since 2001	33	36	69

For more information on annual nesting success see Figure 3.4.1 on page 36

Captive Releases

	Number of Condors
Releases in 2015	11
Total Number of Releases since 1992	133

For more information on the 2015 captive releases see Table 3.5.2 on page 41

Condor Deaths

	Number of Condors
Deaths reported in 2015	10
Total Number of Deaths since 1992	97

For more information on the condor deaths in 2015 see Table 3.3.1 on page 35

Table of Contents

List of Figures

List of Tables

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 lived 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 when available. 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 #480 in flight. *Photo credit: Loi Nguyen*

Condors at interior locations feed on the carrion of mule deer, tule elk, pronghorn antelope, feral hogs, domestic ungulates, and smaller mammals. The diet of condors feeding on the coast also include the carrion of whales, sea lions, and other marine species (Koford 1953; USFWS 1984; Emslie 1987; Burnett et al. 2013).California condors are primarily a cavity nesting species and typically choose cavities located on steep rock formations or in the burned out hollows of old growth conifers such as coastal redwood and giant sequoia trees (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) Hopper Mountain National Wildlife Refuge Complex (Complex) serves as the lead office for the California Condor Recovery Program (Recovery Program) 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. The Service operated a number of different release sites both on refuges and on U.S. Forest Service lands and has annually released condors from the 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 23 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) are the primary management locations for the Southern California condor population (Photo 1.0.2), which currently inhabits portions of San Luis Obispo, Santa Barbara, Ventura, Los Angeles, Kern, Tulare, Fresno, and Inyo Counties.

Photo 1.0.2: Condor #111 soaring over Hopper Mountain NWR. *Photo credit: Joseph Brandt, USFWS*

The California Condor Recovery Plan (Recovery Plan) provides the overarching guidance for field activities. The primary objective driving the reintroduction effort is to establish one of the 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).

To support the second key action in the Recovery Plan, the field team monitors the free-flying population of condors to identify threats and reduce adverse effects to condors, including minimizing mortality factors. Each refuge provides facilities designated for trapping and holding condors, which is necessary for attaching tags and transmitters to condors and performing routine health checks. Another key action in the Recovery Plan is to minimize mortality factors in the natural environment. 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).

The field team is comprised of a number of different positions including Service employees, partner employees, and volunteers. In 2015, the Service employed one full-time permanent supervisory wildlife biologist, two full-time term wildlife biologists, and one full-time term biological science technician.

The Santa Barbara Zoo has been an essential partner for the Recovery Program at the complex. Since 2007 the zoo has assisted with nest management and research in the Southern California condor population with a condor nest technician. In 2015 the Santa Barbara Zoo added an additional condor technician to assist with other condor management activities and to make up for a Service biological science technician position that was discontinued in 2014. The Santa Barbara Zoo also has partnered with the Complex on a major education and outreach project funded by the Urban Refuge Initiative. This Program is called CondorKids.

In addition to the various Service and Santa Barbara Zoo positions, the Complex has four research associate positions that are filled throughout the year. These positions are funded through a cooperative agreement with the Great Basin Institute. Great Basin Institute research associates commit to working 40 to 50 hours a week for a period of six months for a stipend. These positions are also AmeriCorps volunteers through Great Basin Institute and are eligible to receive an educational award which is dependent on the number of hours worked.

Some field activities are also supported by unpaid volunteers or other program partners. Unpaid volunteers primarily assist with monitoring nests during the eight month nesting season but also assist with tracking via radio telemetry 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 Friends of the California Condor Wild and Free helped with outreach events and project work such as building blinds and flight pen maintenance.

1.1 Funding

In 2015, the Complex received $691,047 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. Refuge management funds (126x) also contributed significantly to condor related activities.

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 Research and Condor Survival Fund at the Santa Barbara Museum of `Natural History also made significant contributions.

2.0 Actions

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

2.1 Monitoring 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. Transmitters are assigned to individuals of different sexes and age classes while also considering breeding status or captive release circumstances. GPS transmitter locations are used to understand condor resource use over a large geographic and temporal scale.

The field team's goal 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 or 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 when not trapped for a prolonged period of time. The proportion of condors wearing transmitters depends on how successful the field team is in their trapping efforts.

Use of VHF Transmitters

VHF transmitters allow condors to be tracked in real time. The field team uses 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 for a variety of reasons. For example, VHF transmitters allow newly released condors to be closely tracked or aid in the locating condor nests. VHF transmitters are also important 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.) A remote telemetry station was also piloted at the Bitter Creek NWR in 2015. For more information see Apendix II.

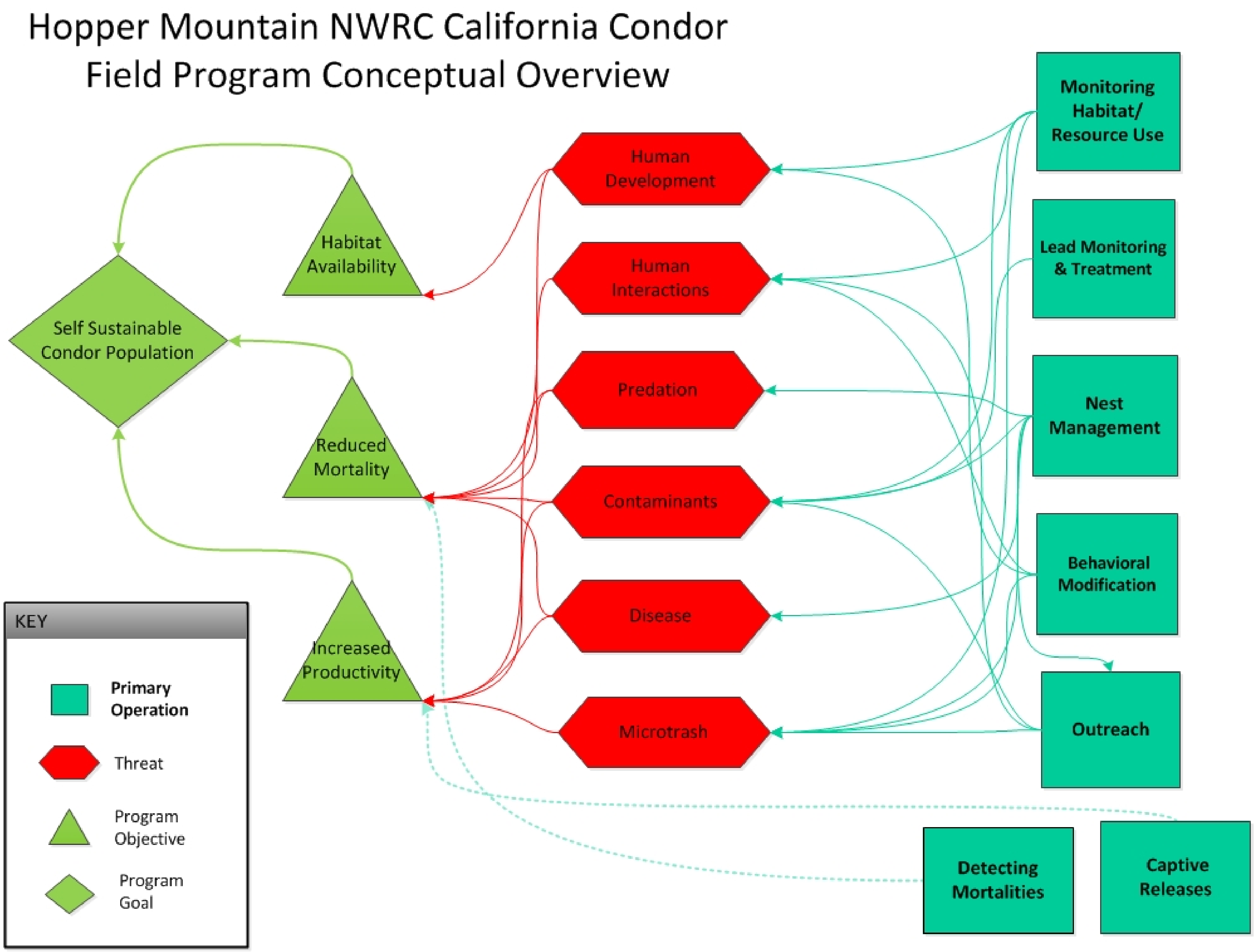


Figure 2.0.1: A conceptual model for the Hopper Mountain NWRC California Condor Field Program. The program's goal is to establish a wild self-sustaining population of condors. The three program objectives are limited by one or more of the six identified threats, which are in turn addressed by the seven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

Photo 2.1.1: Condor #625 wearing a MTI GPS/GSM transmitter. Photo Credit: *Stephanie Herrera, Great Basin Institute.*

Photo 2.1.2: Condor #518 wearing a prototype CTT GPS/GSM transmitter. *Photo credit: Joseph Brandt, USFWS.*

Use of GPS Transmitters

In 2015 GPS transmitters were produced by two manufacturers of solar-powered GPS transmitters that are patagial mounted to a subset of the condor population during routine handling. The transmitters produced by Microwave Telemetry Inc. (MTI; Photo 2.1.1) were very similar in design to the ARGOS/GPS 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 GSM (Global System for Mobile Communications) network.

The transmitters manufactured by Cellular Tracking Technologies (CTT; Photo 2.1.2) also use cell towers to transmit the GPS locations but use a GSM network or CDMA (Code-Division Multiple Access) network depending on the transmitter. The CTT transmitters collect locations every 15 minutes except for two test units which were programed to collect locations every 30 seconds.

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. Non-proffered feeding events and potential threats are prioritized for ground-truthing. A non-proffered feeding event occurs when condors feed on carrion or other food items that are not provided by the condor field team.

GPS transmitter locations also inform program-wide objectives via long-term research projects including efforts to map condor habitat (Cogan et al. 2012), assess the impact and distribution of lead on the landscape (Kelly et al. 2014), and monitor wind energy development as a potential threat. Findings from these studies may influence management strategies and policy aimed at addressing the threats to condor survival.

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 (2008) regulates the use of lead ammunition in California and may reduce the amount of lead contaminated carrion available to scavengers throughout the condor range. Despite this regulation, there is still potential for condors to encounter lead fragments from animals 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.

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. Some condors are tested opportunistically at additional times throughout the year when a lead exposure is suspected or when they are trapped and handled for other purposes. Trap sessions are separated into two periods: January through July and August through December. Normally trapping is conducted for two months during each session: June through July and November through December.

Blood Lead Tests

While handling each condor, the field team collects three blood samples from the medial metatarsal vein using blood vials containing Edetate (EDTA). One sample is used immediately for a field blood lead test using a portable lead analyzer. Additional 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. In addition, feather samples collected from trapped condors are used to monitor lead exposure over longer periods of time. Background lead exposure levels of condors are considered to be below 10 ųg/dL (Cade 2007, Finklestien et al. 2012). A blood lead level higher than 10 ųg/dL is an indication of lead exposure (Finklestien et al. 2012).

Treatment of Elevated Blood Lead Levels

Condors with a field blood lead value below 35 µg/dL are released back into the wild while condors with a field blood lead value greater than or equal to 35 µg/dL are transported to the Los Angeles Zoo for treatment. Treatment involves radiographing the condor to identify possible metallic objects in the digestive system and administering chelation treatment to remove lead from the bloodstream (Photo 2.2.1). The field team also samples the blood lead levels of wild condor chicks during routine nest entries and treat them at the nest requiring additional nest entries if necessary (see: 2.4 Nest Management section).

Photo 2.2.1: Los Angeles Zoo Condor Keepers prepare a lead poisoned condor for radiographing. *Photo credit: Jon Myatt, USFWS.*

Chelation treatment consists of daily intramuscular injections of Calcium EDTA given in conjunction with subcutaneous fluids. Lead toxicosis can result in crop-stasis, or the inability to transfer food past the crop, which can result in severe weight loss and starvation. Treatment time varies between weeks to months depending on the level of lead exposure. Zoo 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 monitors condors with metallic-positive radiographs. When possible, they recover castings and fecal material, and remove metallic objects for analysis. 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 toxicosis.

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. 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 in order to determine the cause of death and 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.

The field team usually detects condor mortalities using VHF transmitters attached to each condor. All deployed VHF transmitters have an automatic mortality signal function. After a 12-hour period of inactivity, the VHF transmitter will emit a beep with a frequency about twice as fast as the normal rate, also called a mortality signal. When a mortality signal is detected, 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 dead.

GPS transmitters 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 may indicate mortalities.

Condors are monitored throughout the day using radio telemetry at both Hopper Mountain NWR and Bitter Creek NWR. If a condor goes undetected for more than one week, the field team will expand their search for the missing condor by mobile tracking. Mobile tracking involves driving to various off-refuge locations throughout the Southern California condor range to search for the signal of the missing condor (Photo 2.3.1).

Condor chick mortalities are detected during routine nest monitoring (see: Nest Management section). 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 in order to determine cause of death.

Photo 2.3.1: Nadya Seal Faith tracking condors using radio telemetry. *Photo Credit: Devon Pryor Santa Barbara Zoo*.

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. The field team identified the leading cause of nest failure as the consumption of small, human-made materials, also called 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 chicks ingest large quantities of microtrash it can result in digestive tract impaction, evisceration, internal lesions, and death (Grantham 2007; Snyder 2007; Rideout et al. 2012).

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 (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.

Photo 2.4.1: Microtrash removed from a wild chick in 2008. *Photo Credit: USFWS*.

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 tracking courtship behaviors (Photo 2.4.2). Existing pairs will often re-nest in previously used cavities or in cavities located close to previously used 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).

Nest Observations

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 for two to four hours, two to three times per week, from the nest observation point. 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 straying outside the obscured cavity.

Photo 2.4.2: Condor #247 displays to condor #79. *Photo Credit: Stephanie Herrera, Great Basin Institute.*

The field team also monitors some nests with nest cameras. Nest cameras are typically installed in nests during the first nest entry conducted during the egg stage of the nest (Photo 2.4.3). 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 activity at the nest. Nest locations may also be too remote and thus very difficult to access for camera setup and maintenance.

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 the footage every three to four days. Reviewers monitor parental attendance, chick activity levels, and any signs of distress or abnormal behavior.

Photo 2.4.3: Supervisory Wildlife Biologist, Joseph Brandt, installs camera equipment outside the cavity at KR15. *Photo Credit: Josh Felch, USFWS***.**

Nest Entries

The field team also monitors condor nests with regularly scheduled nest entries. Nest entries occur to check egg fertility and to confirm the hatch of the egg when it cannot be seen by an observer or nest camera. The field team then enters nests to give the chick a health exam to assess the chick's development and overall health. 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 also sifted for any foreign material during each entry. The chick is also vaccinated against West Nile virus while being examined. Nests are entered twice during the chick stage to examine the condor chick. These entries occur at 60 days and 120 days. In previous years nests were entered four times when the chick was 30, 60, 90, and 120 days old. During the 120-day nest entry, the chick is also fitted with a patagial tag and VHF transmitter (Photo 2.4.4). Biologists do not enter the nest after 120 days in order to avoid possible premature fledging.

Photo 2.4.4: Los Angeles Zoo Condor Keeper, Jenny Schmidt, handles condor #774 for an exam and tagging at nest PC15. *Photo Credit: Joseph Brandt, USFWS*.

Nests with nest cameras are also entered during the egg stage (this is when the camera is installed) and when the chick is ready to be tagged at 120 days of age. Nest cameras allow the chick's development and health to be monitored remotely with the nest camera.

Some condor nests are very remote or too difficult to access. These nests are monitored through visual observation, or VHF and GPS tracking of the parents. If a chick fledges from a remote nest, the patagial tag and VHF transmitter will be fitted during the biannual trapping, at which time the bird will receive a West Nile Virus vaccination.

In order to enter condor nests safely, field team members are specially trained in using ropes to descend and ascend the steep cliff faces where nests are located and in handling condor eggs and chicks of various ages. The Service conducts a ropes training at a local rock climbing area every year at the start of the nesting season and the Los Angeles Zoo captive breeding center provides the handling training for the field team.

Nest Interventions

The field team conducts nest interventions when problems arise at the nest to ensure success of the nest. During the egg stage, nonviable eggs are removed and replaced with dummy eggs, which are later switched with viable captive-laid eggs. Additional interventions will occur as needed to mitigate threats detected through observations, such as chick injuries or poor development. If a significant amount of microtrash, more than 40 items, is collected during the 60-day entry, the nest is entered again at 90 days.

The field team uses nest cameras during some interventions to closely monitor the results of the intervention. In these instances, footage from the cameras are shared with veterinarians and behavioral experts to assess a chick's status and recovery while it remains in the nest post treatment. The presence of cameras have 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: Captive Releases and Transfers section). Through observation, we aim to ensure fledglings are integrating into the population and displaying normal behavior and continue to receive parental care.

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. Chick carcasses are submitted for necropsy to the U.S. Fish and Wildlife Service Wildlife Forensics Laboratory in Ashland, Oregon.

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 intrinsic rate of reproduction through a captive breeding program (USFWS 1996). Captive-bred California condors selected for release in the wild must be physically and behaviorally healthy, have been successfully socialized with other release candidates, have been kept in isolation from humans to prevent taming, and have undergone aversion training to condition avoidance of power poles (Bukowinski et al. 2007, Clark et al. 2007, USFWS 1996).

Husbandry

Prior to release, condors spend time in a flight pen (or captive enclosure) at Bitter Creek NWR (Photo 2.5.1). These pre-release condors spend at least six weeks in the flight pen to allow familiarization with the new surroundings and interactions 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 examine and record social behavior and physical health. On the day prior to release, biologists place identification tags and VHF transmitters on each condor and move condors into a secondary enclosure within the flight pen.

Photo 2.5.1: Captive-bred California condors await release in a flight pen. *Photo Credit: Lisa Cox, USFWS.*

Releases

The field team typically releases California 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 water and supplemental feeding sites.

Carrion is provided near the release pen in order to lure other free-flying condors in to feed and interact with the newly released condors. Supplemental feeding is an integral component of the condor release program (USFWS 1996). Supplemental food and water act 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. This behavior includes approaching humans, not socializing with other condors, roosting on the ground, and/or the inability to locate supplemental food.

2.6 Behavioral Modification

The California condor is an inquisitive species whose habitat overlaps with human development. The frequency with which the condor encounters human activity and development has led to isolated incidences of habituation. Condors that have become overly habituated to human activity and structures are at greater risk to behavioral conditioning, which ultimately affects their ability to survive in the wild. A habituated condor may also cause other condors to become habituated given the social nature of the species. Condors have also caused property damage and jeopardize human safety in the event a habituated condor approaches people.

Categories of Undesirable Behavior

Cade et al. (2004) grouped undesirable behavior into three categories. Type I behavior is considered normal and is categorized by condors remaining at least 15 meters from people, exploring anthropogenic objects infrequently, landing on human-made structures limited to those that resemble natural perches or offer adequate protection from predators, and abandoning the undesirable behavior after one to two deterrence activities, i.e., “hazing” or “aversion training” (Cade et al. 2004). Hazing is defined as “an activity directed at a condor by humans in attempt to discourage a behavior” while aversion training is defined as “making an undesirable activity or behavior unpleasant without direct human interaction” (Grantham 2007).

Type II behavior is an “intermediate category”, and is exemplified by condors “landing or flying closer than 15 meters to humans, but maintaining an ‘individual distance’ when approaching or being approached by humans” and “circumventing humans when investigating their belongings, allowing close human approach only when a clear escape route is present” and “fleeing when hazed” (Cade et al. 2004).

Type III behavior is of utmost concern, and “consists of condors allowing close human approach when no escape route is present (no fear of being boxed in), seeking out and initiating contact with humans, allowing touching and handling (including capture)” and “not responding to hazing, and showing no fear of humans” (Cade et al. 2004). These types of behaviors have also been observed in similar vulture species in the United States including the black vulture [Coragyps atratus] (Lowney 1999).

Although lowest on the undesirable behavior spectrum, even Type I behaviors can cause risks to condors. While this category is not associated with approaching humans, it does result in condors approaching or landing on human structures. In many cases, these structures are hazardous because condors can become entangled or entrapped on or in structures or ingest poisonous household or industrial items, leading to injury or death (Photos 2.6.1 and 2.6.2).

Photo 2.6.1: Condor #412 entangled and hanging from a communications tower in May 2011. The injuries from this incident were so severe the condor was euthanized. *Photo credit: USFWS*

Photo 2.6.2: Condor #63 covered in motor oil at Rancho la Cruz. *Photo credit: USFWS*

Behavioral Management

The field team employs aversion training, hazing, and trapping of habituated condors as means to manage Type I and II behaviors and prevent Type III behaviors and subsequent injury to condors. In the early stages of reintroducing condors into the wild, a number of mortalities were attributed to power line collisions and electrocution. As a result, pre-release flight pens feature mock power poles that deliver nonfatal electric shocks to any condor landing on the structure. This aversion training has proven very effective in conditioning pre-release condors to avoid these structures once they join the free-flying population. Collaboration between the field team and Southern California Edison bolstered this aversion training with the installation of life-sized mock power poles outside both of the flight pens at Bitter Creek NWR and Hopper Mountain NWR in 2014, which serve as a means to train wild fledged chicks and reinforce the training in the rest of the flock.

The field team identifies habituation sites and habituated condors using radio telemetry, GPS transmitter data, visual monitoring, and responding to reports of condors engaged in undesirable behavior. Hazing, in combination with removing any potential attractants, has been effective at discouraging condor activity at many locations.

Hazing techniques include making loud noises, clapping and waving hands, using slingshots with non-injurious food items (e.g. grapes and gumdrop candies), spraying streams of water from hoses and water guns, and using restrained dogs. Hazing is an effective deterrent only when done quickly and consistently. Inconsistent hazing can allow condors to develop a tolerance of the hazing techniques thereby lessening its effect.

Anti-perch deterrents help discourage condors from landing on human structures and are recommended to residents who have condors perching on their homes. Examples of anti-perch deterrents include bird spikes, shock strips, spring wire, bird spiders or motion-activated sprinklers.

The capture of condors due to habituation issues is considered a last resort, but on rare occasions is necessary for the safety of the individual condor or the benefit of the condor population. The capture of an individual is necessary if the condor exhibits Type III behavior, exhibits Type II behavior and no longer responds to deterrence activities, or exhibits Type II behavior and the recurring stimulus presents an immediate risk of physical harm or death. Often times, the captive condor is given a "time out" period in the flight pen, usually lasting a few months or longer, and then released back into the wild. In some circumstances, however, the habituated condor's behavior warrants a permanent return to captivity.

Access to the location where the undesired behavior is occurring is also an important factor. Without access to the affected individual, the only course of action to correct persistent or harmful undesirable behavior is to capture and remove that individual from the wild in attempt to break the pattern of behavior.

2.7 Outreach

The field team performs outreach to create awareness and educate the public about issues pertaining to California condor conservation in Southern California. Performing outreach for condors also helps further the Service's national goals of connecting people with nature and broadening awareness of endangered species conservation and the National Wildlife Refuge System (Photo 2.7.1).

Photo 2.7.1: Pasadena Audubon Young Birders observe the release of Condor #20 at Bitter Creek NWR. *Photo Credit: Josh Felch, USFWS*

Condor Cave

The "Condor Cave" is a Facebook page that is being managed in partnership with the Santa Barbara Zoo. The page has been active since 2012 and highlights the condor conservation efforts taking place in Southern California. The page showcases condor courtship and nesting behaviors using 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 has partnered with them along with the Santa Barbara Zoo and the Western Foundation of Vertebrate Zoology to host a condor nest camera online. This project has taken three years to come online and 2015 was the first year that a wild condor nest camera was streamed live online to the public.

CondorKids

The Complex also partnered with the Santa Barbara Zoo to create a new education program called CondorKids. CondorKids 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 third grade curriculum for students that meets Common Core and National Science Standards. The curriculum teaches skills in science, technology, engineering, and math (STEM) 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 teacher. Locally, CondorKids targets urban youth in Ventura County. For these local groups it also provides students the opportunity to experience condor recovery first hand by offering field trips to the Hopper Mountain NWR, Bitter Creek NWR, or the Santa Barbara Zoo.

Non-lead Outreach

The Institute for Wildlife Studies Southern California Non-lead Outreach Coordinator is stationed at the Complex office in Ventura. This position 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 setting up educational booths at sportsman shows (Photo 2.7.2), conducting shooting events at local shooting ranges, making contacts with local ranchers and providing them with free non-lead ammunition, and providing presentations for other interested outdoor organizations and groups.

Photo 2.7.2: Non-lead outreach table at the Hunters Education Instructors Training Conference in Squaw Valley, CA. *Photo Credit: Institute for Wildlife Studies*

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 Friends Group, and presents to local schools. When possible, the Service accommodates media requests and contributes to several social media outlets and scientific publications.

Outreach is also targeted to help resolve immediate management issues. A common example of this is providing information to communities and local residents within condor range where the potential for condor habituation with humans and human structures is likely. In these cases, the field team provides information to residents about how best to discourage condor habituation. 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.

3.0 Outcomes

3.1 Monitoring Resource Use

GPS Transmitter Locations

In 2015, 34 of 78 condors in the Southern California condor population wore GPS transmitters for at least part of the year. GPS transmitter data produced 1,190,153 locations. Eight condors wearing MTI transmitters produced 743,226 locations and 26 condors wearing CTT transmitters produced 446,927 locations.

Population Distribution

Condor activity across the landscape, based on this subset of California condors, spanned approximately 15,300 square miles (the area of a single polygon containing all GPS locations; Figure 3.1.1). Condors from the Southern California population ranged from the Santa Monica Mountains in the south to the Southern Sierra Nevada Range in Fresno County to the north. They ranged east into the Santa Lucia Mountains of Monterey County and the eastern most flights were in the San Gabriel Mountains north of Ontario in eastern Los Angeles County. 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 in Ventura County near Hopper Mountain NWR (Figure 3.1.2). Condors also concentrated activity near Bitter Creek NWR, though less so than the Tehachapis or the southern Sespe Wilderness.

Exceptional Flights

As in previous years, a number of condors made atypical flights into areas where the population has not been very active. Three flights are worthy of note. On March 16, 2015, condor #648 flew into the Santa Monica Mountains (Figure 3.1.3). This is the first confirmed record of condors in the Santa Monica Mountains since their reintroduction in 1992. Condor #648 did not appear to land in the area but did fly over the Santa Monica Mountains National Recreation Area before flying back to the north. Condor #625 made a three day flight to the Sierra National Forest in Fresno County (Figure 3.1.4). Condor #625 roosted in the western foothills of the Southern Sierra Nevada Mountains near Sequoia National Forest during this trip. On August 28, 2015, condor #192 flew to the Santa Lucia Mountains in Monterey County (Figure 3.1.5). Condor #192 was originally released by the Ventana Wildlife Society in 1999 in the Santa Lucia Mountains, near Big Sur, CA. She relocated to Southern California and paired with condor #21 in 2004. This was the first time she returned to the Big Sur region in 6 years. Condor #192 was found dead shortly after this trip (see 3.3 Detecting Mortalities for more information).

Activity Near Wind Turbines

A total of 12 condors were detected via GPS transmitter within the development foot print of wind energy facilities in the eastern Tehachapi Mountains in 2015.

Condors #180, #255, #526, #585, #636 and #683 were detected within footprint of the Alta Oaks Creek Wind Facility (Figure 3.1.6). Four of the six condors had GPS locations with speeds less than 10 km per hour indicating that the condor was perched on or close to the ground. Condors #147, #255, #365, #374, #480, #487, #509 #513, #585, and #683 were all detected within the footprints of the Manzana or Pacific Wind Facilities (Figure 3.1.7). The number of condors coming in close proximity to operational wind energy facilities has increased since the previous year.

Nest Distribution

Nesting activity in 2015 occurred on public and private land. Seven nests were located on the Los Padres National Forest, four of which were in the Sespe Condor Sanctuary. Two nests were located on the Bureau of Land Management lands to the west of Hopper Mountain NWR. One nest was located on private land east of Hopper Mountain NWR and south of the National Forest (Figure 3.1.8).

Non-proffered Feeding

The field team confirmed 14 non-proffered feeding events in 2015 (Photo 3.1.1). The most common types of carrion observed at non-proffered feedings were cow, deer, and pig. This is similar to carrion types from years prior (2008 – 2014; Table 3.1.1). It is likely that this represents only a small portion of the number of nonproffered feeding events that occurred in 2015.

Another consideration related to the amount of non-proffered feeding was the amount of proffer food that was available to the flock. By not releasing captive bred condors in the fall of 2014 supplemental carrion placements were only used for trapping purposes until releases began in October of 2015. Non-proffered carcasses was the only food available to the flock have the year. Supplemental carrion was not placed for four consecutive months in the winter and spring (February through May) and for two consecutive months in the summer (August and September).

Photo 3.1.1: A group of condors perched near a non-proffered elk carcasss in the Tehachapi Mountains. *Photo Credit: Dave Rivas*

Table 3.1.1: Non-proffered feeding events in 2015, 2008-2014, and in total 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 2015		Years Prior 2008-2014		All Years 2008-2015	
cow	5	36%	49	34%	54	34%
pig	2	14%	55	38%	57	36%
deer	5	36%	18	12%	23	14%
horse	1	7%	6	4%	7	4%
sheep	0	0%	6	4%	6	4%
unknown	0	0%	5	3%	5	3%
coyote	0	0%	2	1%	2	1%
bison	0	0%	2	1%	2	1%
goat	0	0%	1	1%	1	1%
donkey	0	0%	1	1%	1	1%
elk	1	7%	1	1%	2	1%
Total	14		146		160	

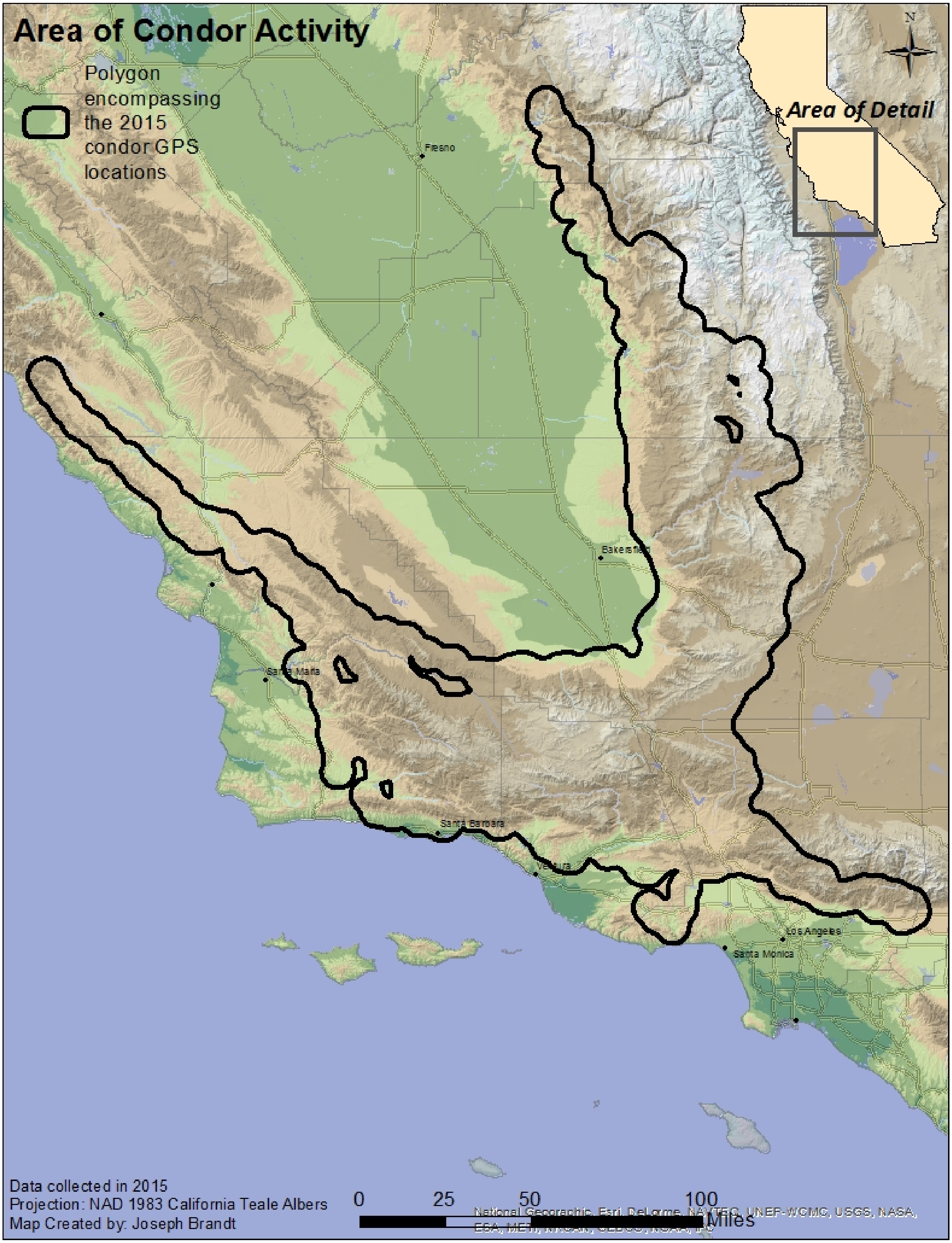


Figure 3.1.1: 2015 estimated area of activity of the Southern California condor population. To estimate the area of condor activity, a polygon created using a 3 mile buffer of the 100 percent isopleth of a fixed kernel density estimate and smoothed with the Polynomial Approximation with Exponential Kernel (PAEK) algorithm with a 2 mile smoothing tolerance.

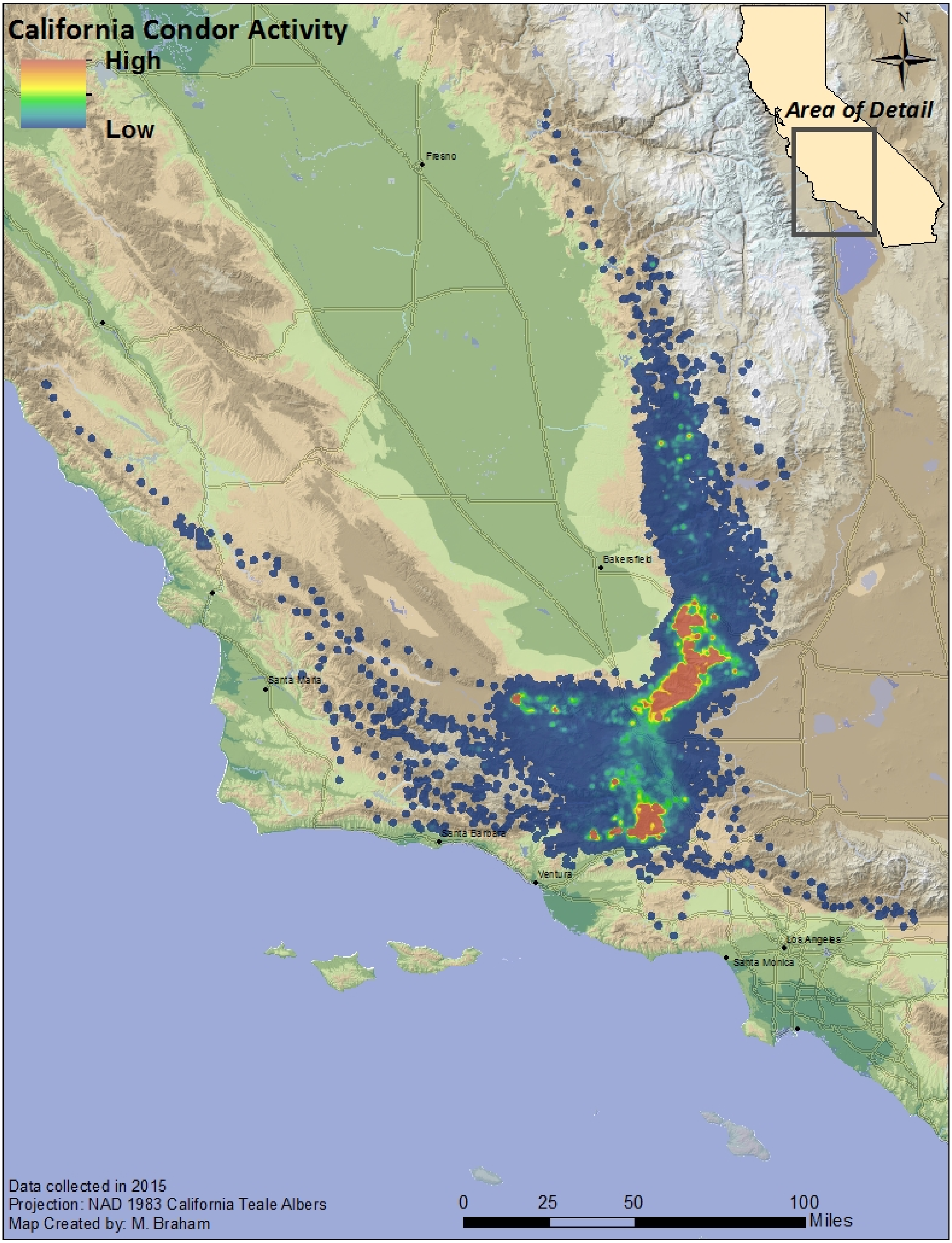


Figure 3.1.2: Southern California condor activity in 2015 estimated using a fixed kernel density estimate (KDE) for all California condors wearing GPS transmitters. KDE averaged across individuals (n=34) using a neighborhood of one kilometer (cell size = 100 meters) and stretched using two and a half standard deviations. KDE provided by Melissa Braham, Survey Technician (Division of Forestry and Natural Resources, West Virginia University).

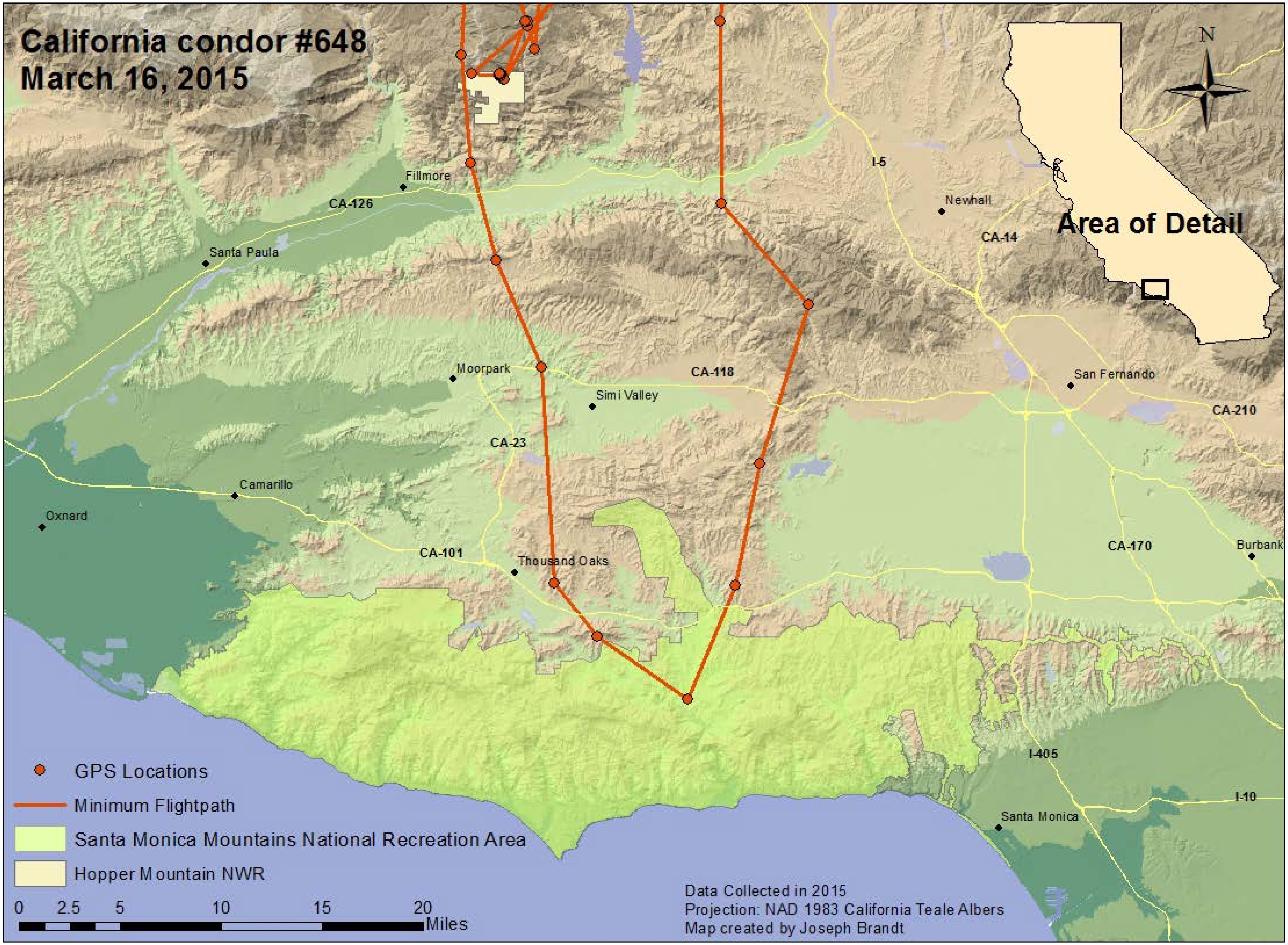


Figure 3.1.3: Flight path of condor #648 on March 16, 2015. Condor #648 flew within 5 miles of the Pacific Ocean to south of Hopper Mountain NWR. This is the first reliable record of condors flying over the Santa Monica Mountains since their reintroduction into the wild in 1992.

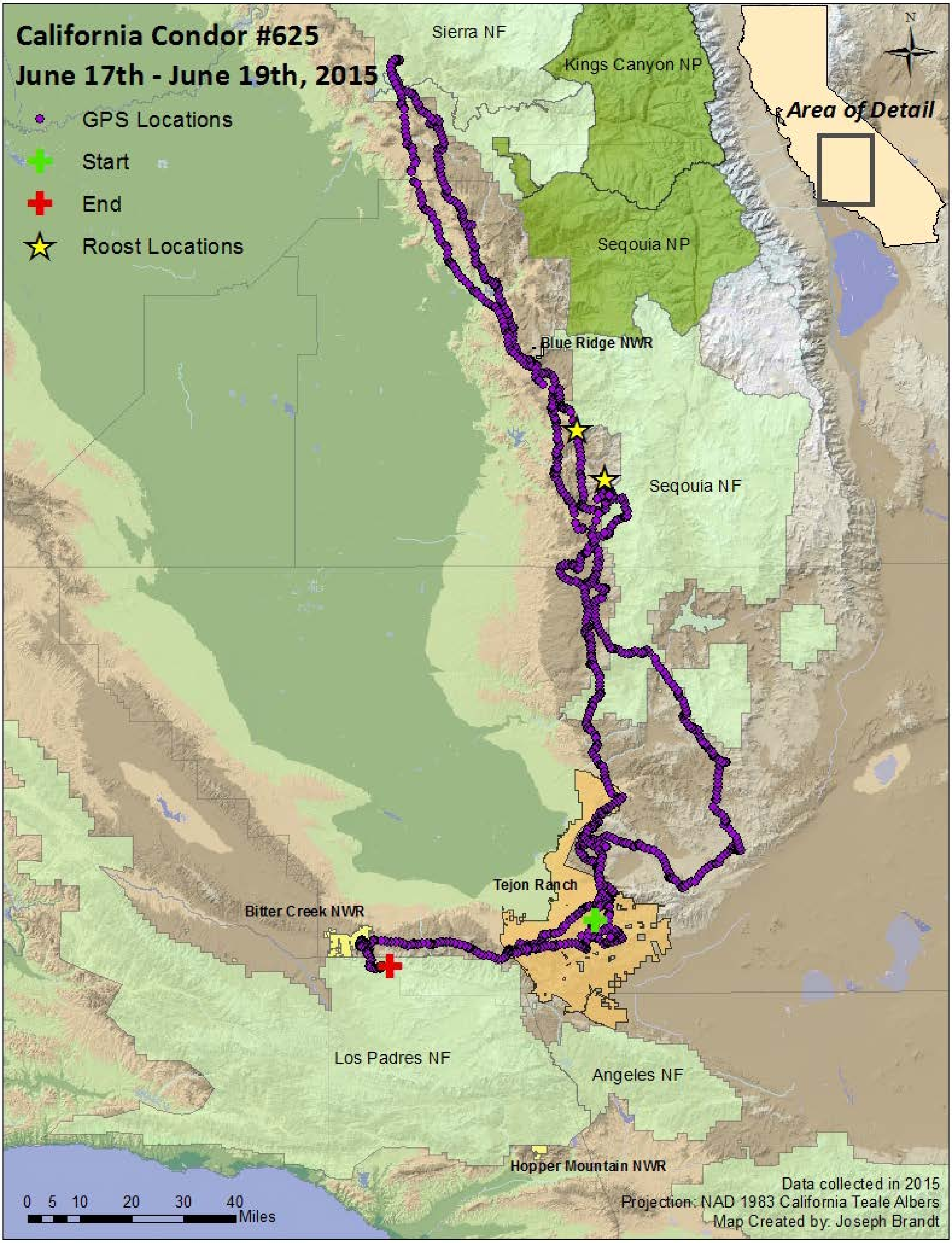


Figure 3.1.4: Flight path of condor #625 from June 17, 2015 to June 19, 2015. On June 17, condor #625 flew into Tulare County and roosted just west of Sequoia National Forest. The next day, #625 continued north reaching Sierra National Forest in Fresno County and then returned south. At the time #625, was the northern most condor in California, flying further north any condors in the Central California population

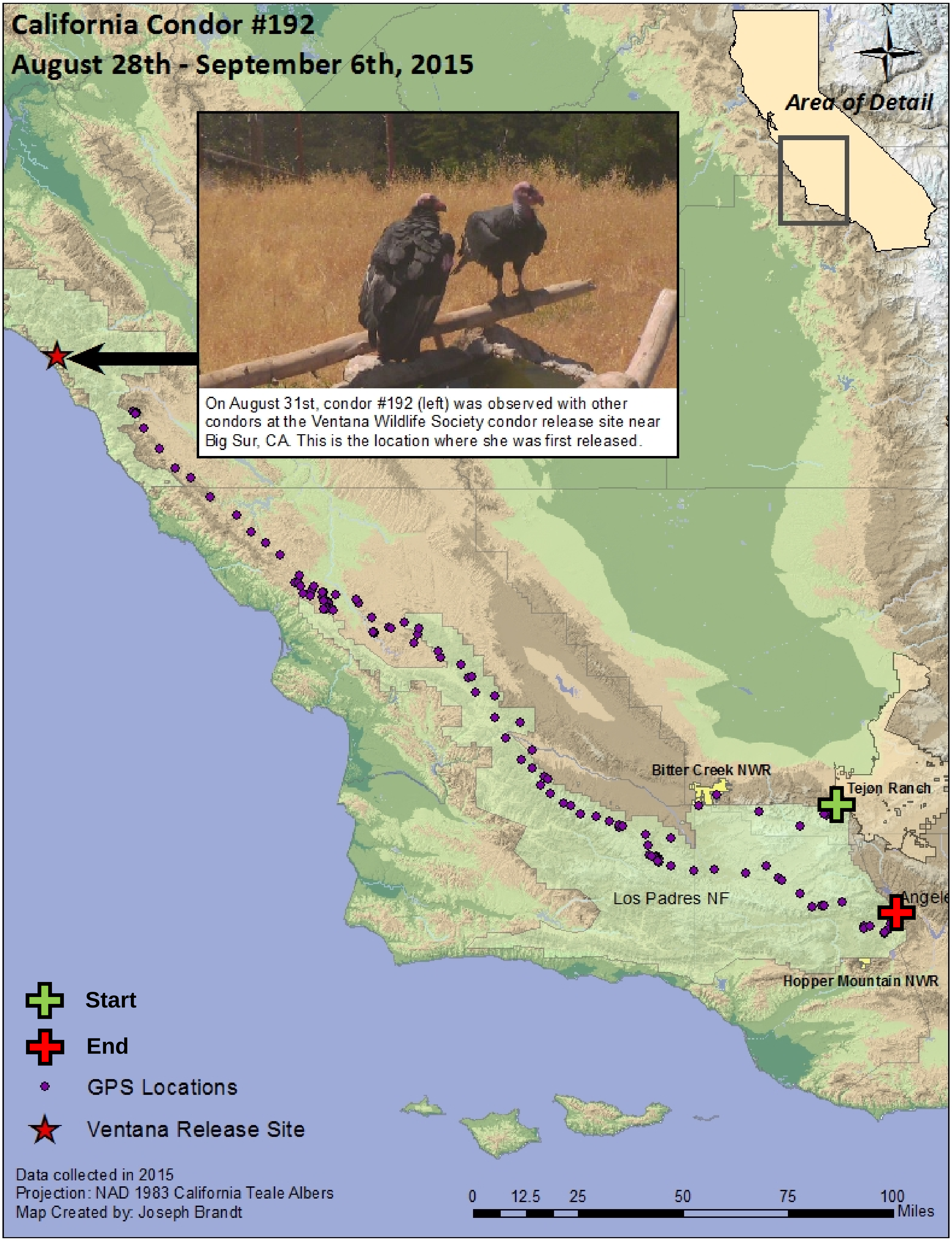


Figure 3.1.5: Flight path for condor #192 from August 28, 2015 to September 6, 2015. Condor #192 returned to the location where she was originally released where she fed and interacted with other condors in Central California. She returned nine days later to Southern California where she had an active nest. *Photo Credit: Joe Burnet, Ventana Wildlife Society*

2015 Condor Activity Near Wind Turbines: Alta Oak Creek

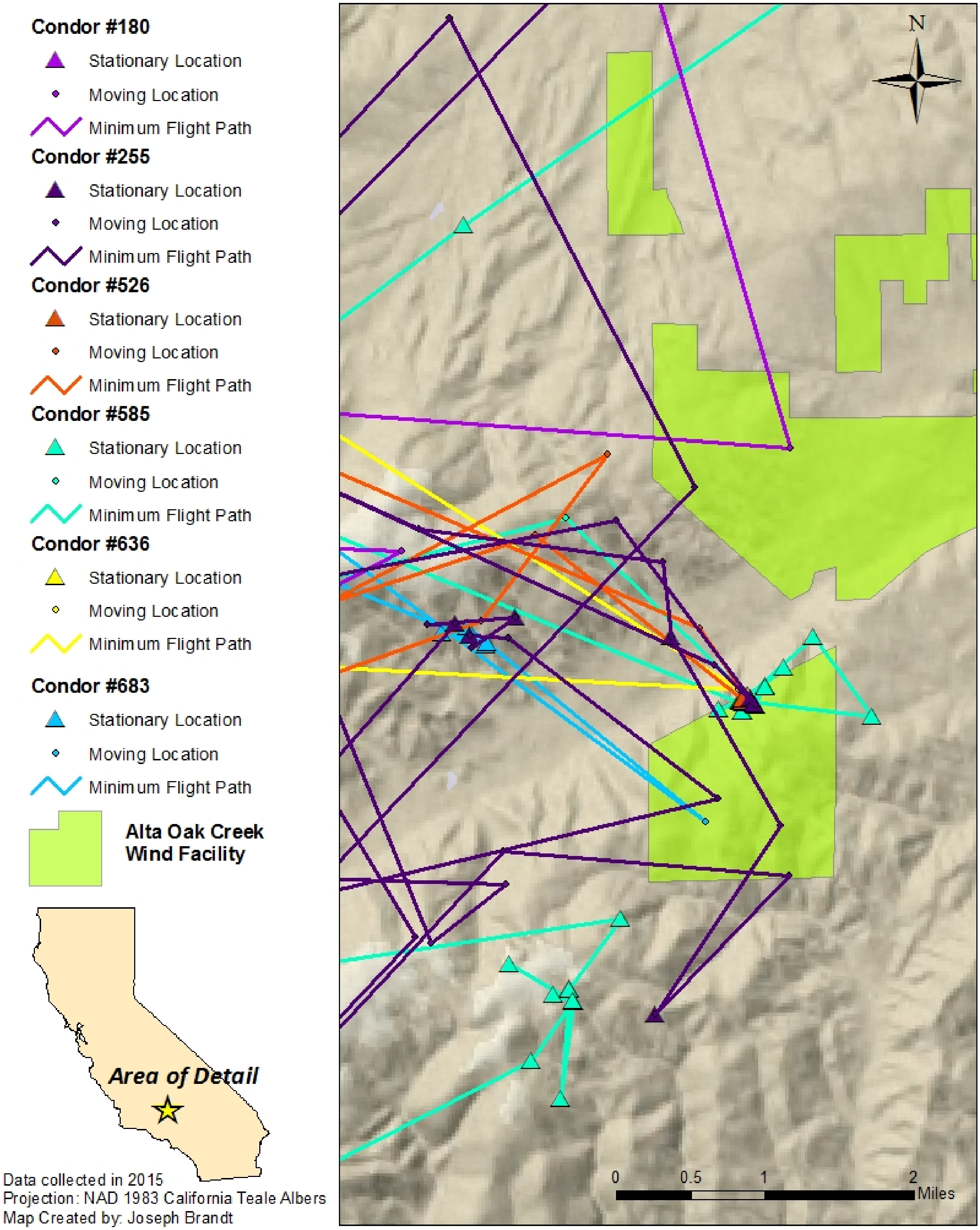


Figure 3.1.6: 2015 condor activity near Alta Oak Creek Wind Facility. Condors #180, #255, #526, #585, #636 and #683 were detected both perched within and flying over the Alta Oak Creek Wind Facility. Moving locations are any location with a speed greater than 10 km and stationary locations are any location with a speed less than 10 km.

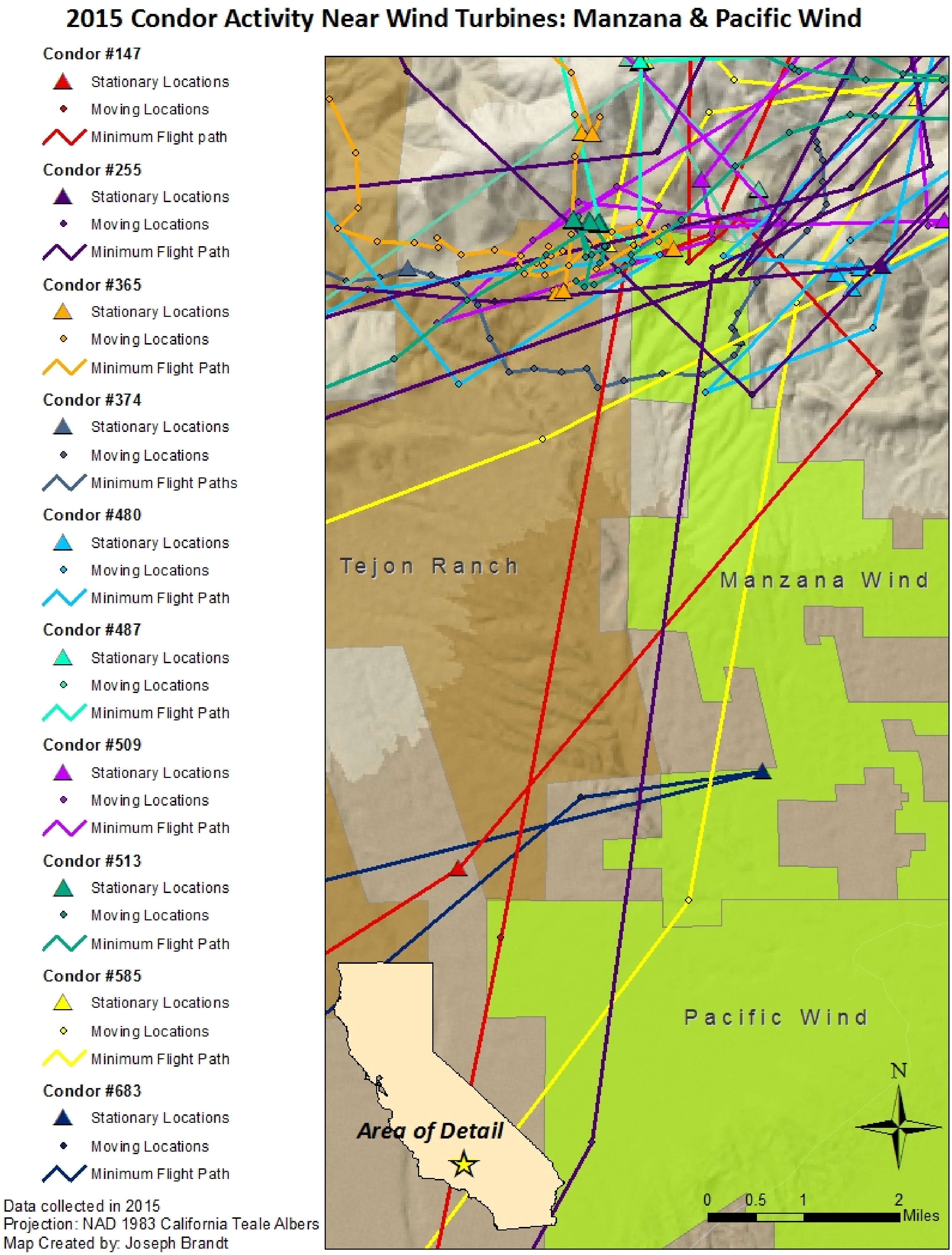


Figure 3.1.7: 2015 condor activity near the Manzana Wind and Pacific Wind facilities. Condors #147, #255, #365, #374, #480, #487, #509, #513, #585, and #683 were detected either perched or flying within the Manzana Wind or Pacific Wind facilities. Moving locations are any location with a speed greater than 10 km and stationary locations are any location with a speed less than 10 km.

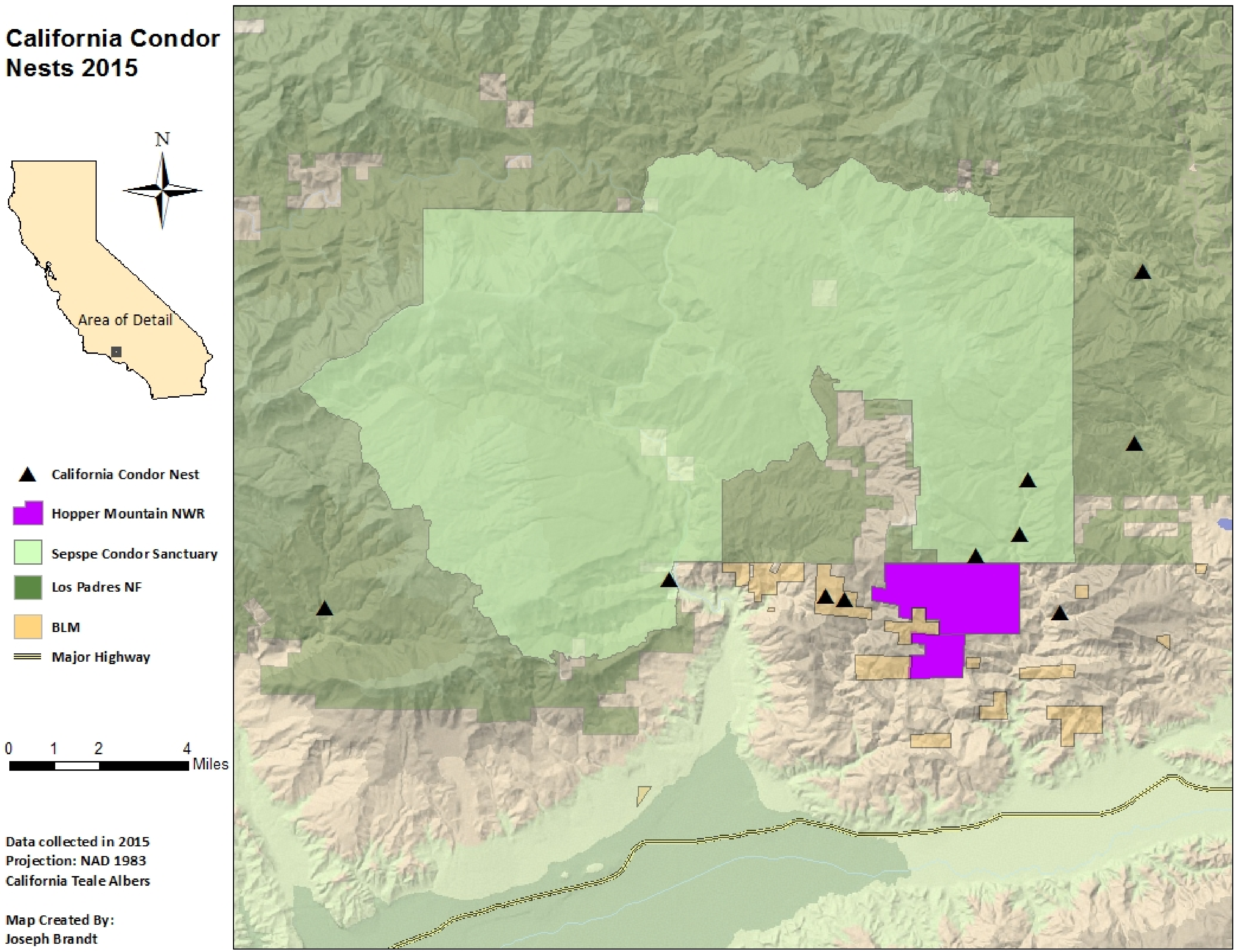


Figure 3.1.8: Locations of condor nests in 2015 (n = 10 nests).

3.2 Lead Monitoring and Mitigation

Trapping Effort

In 2015 extenuating circumstances created a need to trap outside of the normal June/July and November/December periods. Trapping was conducted in January of 2015 as a result of predator activity at Bitter Creek NWR and low staffing levels which delayed the start of the second trapping session of 2014 until December.

The field team and volunteers spent approximately four to five days per week in blinds trapping during each trap month when trapping occurred. The field team handled condors several times during each trapping session with each condor requiring about 30-45 minutes of handling time and, depending on the number of condors, between two to 15 biologists assisting at each handling event.

Trapping Success

During the two 2015 trapping sessions, 41 of the 67 (61%) targeted condors were trapped (Table 3.2.1). There were 67 trappable condors, which differs from the end of the year population size of 78. The number of trappable condors differs from the end of year population number because it does not include newly released condors in the fall 2015 or condors that died prior to the start of a trapping period. In total, the field team handled condors 58 times, not including chicks and pre-release condors.

Blood Lead Test Results

Forty-one condors in the Southern California population were tested a total of 69 times in 2015. Sixteen condors were tested twice and one condor was tested 3 times. While there were fewer test results than the previous five years, the results are comparable (Figure 3.2.1). When using the highest lab blood lead level for each condor tested, 39 of the 41 condors (95%) had lab blood lead levels above background levels (10 ųg/dL). Nine condors (22%) had field blood lead levels greater than 35 ųg/dL and were held for treatment.

The field team conducted 11 blood lead level tests on 6 wild condor chicks during the 2015 nesting season. None of the condor chicks' blood lead levels were high enough to require treatment. However, condor chick #793 was found dead below the Koford's Ridge nest on September 23rd. The remains were sent to the USFWS forensics lab and the cause of death was determined to be lead related.

Treatment of Elevated Blood Lead Levels

The field team transported nine individual condors to the Los Angeles Zoo for 11 chelation treatments in 2015. Of the nine treated condors, two condors, #480 and #526, received chelation treatment on two separate occasions. Condor #360 was transported to the Los Angeles Zoo with a high blood lead level in January and was held in captivity for over 9 months before being released back into the wild (see 3.5 Captive Releases and Transfers).

Table 3.2.1: Comparison of condors trapped between sessions and in total for 2015. 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 are typically not re-trapped until the following year.

Trap Session	Number of Individual Condors Targeted	Number of Individual Condors Trapped	Percentage of Targeted Condors Trapped
Jan - Jul	67	37	55%
Aug - Dec	66	18	27%
Total for 2015	67	41	61%

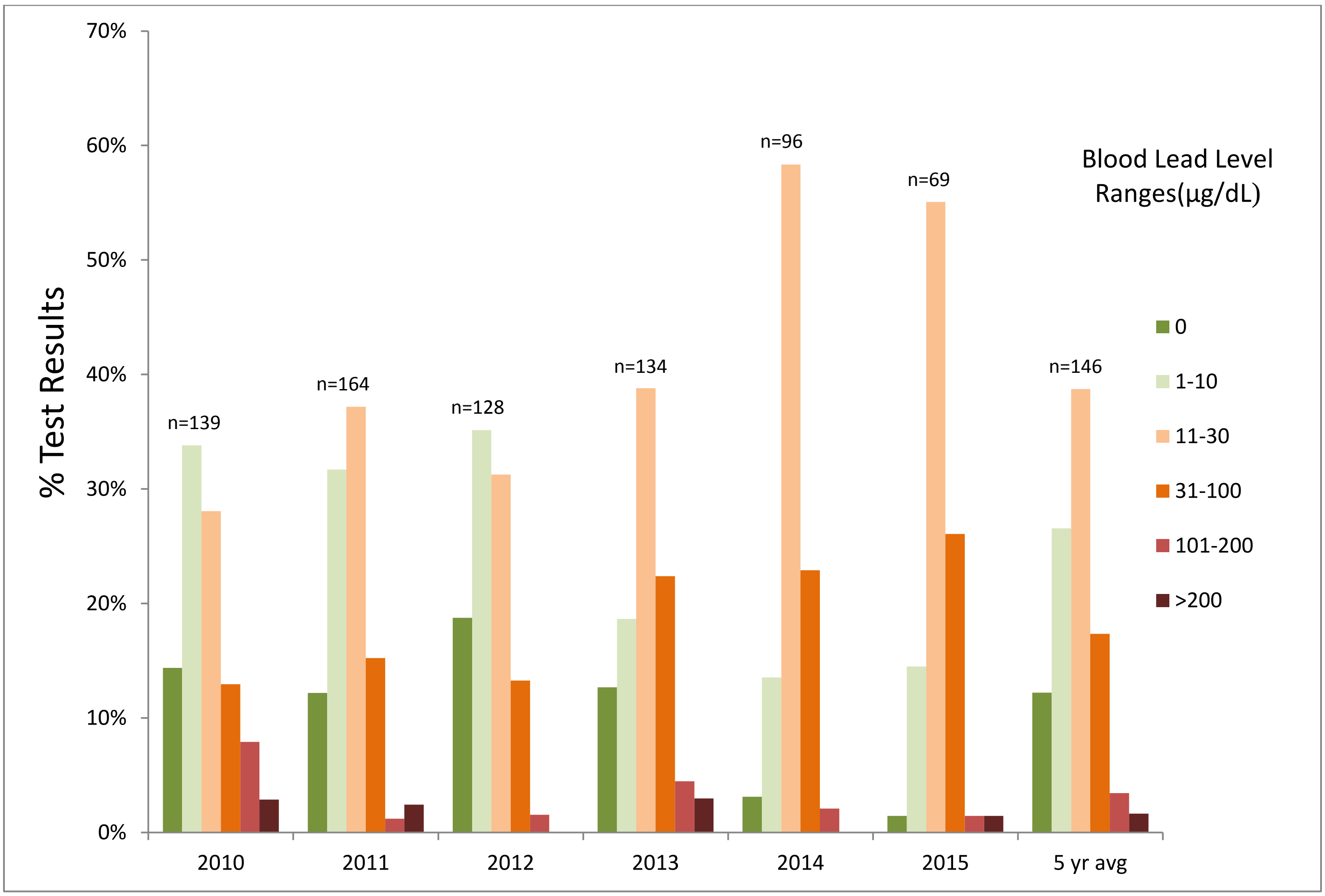


Figure 3.2.1: Summary of condor blood lead levels by year from 2010-2015 and the 5 year average (2010-2014). All of the lead values given represent lab blood lead values. Values returned as "not detected" are indicated by zero. Number of tests performed on the Southern California population of condors each year represented as "n" for each year.

3.3 Detecting Mortalities

Two free-flying condors, five chicks, and one pre-release condor died in Southern California during 2015 (Table 3.3.1). In addition to these deaths, two condors have gone undetected in the wild for greater than a year and are presumed dead with approximate death dates in late 2014 (dates of last detection). Of the 2015 mortalities, two condors died of lead toxicosis, one condor was euthanized, two condors died of undetermined causes, one condor went missing from its nest cavity, and one condor is currently unrecovered.

Death of Condor #192

Adult female condor #192 was reported to the field team as being found dead by a hunter on Tejon Ranch on October 26, 2015. Postmortem examination revealed a lead particulate in the stomach contents and elevated bone lead levels confirming the cause of death as lead toxicosis (Necropsy Report #15-0311).

Photo 3.3.1: Condor #192 recovered on private inholding on Tejon Ranch. *Photo Credit: Eddie Owens, USFWS.*

Death of Condor #778

Condor #778, the fledgling of condor #192, was last observed alive on November 5, 2015 in his nest area with a mortality signal being detected on November 19, 2015 from Hopper Mountain NWR. It is unlikely that the mortality signal is a dropped transmitter as it is sewn into the patagial tag on condor #778. Due to the difficult access of the area in which the mortality signal is emanating, the remains of condor #778 have gone unrecovered and the cause of death is unknown.

Death of Condor #793

The scavenged remains of condor chick #793 were recovered from the area below its nest cavity after a volunteer nest observer reported a mortality signal. In the days prior, the chick had moved to a ledge below the nest and eventually out of view of both the live streaming nest camera (see Nest Management and Outreach sections) and nest observers. Postmortem examination revealed elevated levels of lead in the liver and bone as well as lead particles in the ventriculus indicating lead toxicosis as the cause of death (Necropsy Report #15-0291). This is the first confirmed case of a wild chick death caused by lead poisoning.

Death of Condors #779 and #792

Condor chick #779 was recovered from its nest cavity after a nest observer reported that it appeared to be lifeless. A necropsy of the carcass was unable to determine the cause of death (Necropsy Report #15-0135). Condor #792 was evacuated from the nest due to an apparent injury and was later euthanized at the Los Angeles Zoo (see 3.4 Nest Management). The chick had suffered multiple fractures from a suspected rock fall (Necropsy Report #15-0246).

Death of Condor #724

Juvenile condor #724 was a pre-release condor that had been placed in the Bitter Creek NWR flight pen for acclimation to the area and behavioral observation prior to its expected release later in the year. He was transported to the Los Angeles Zoo after he was observed being lethargic, antisocial, and not eating. His condition worsened while in treatment and he was found dead during the zoo keepers' morning health checks five days later. Lead, West Nile Virus, and botulism lab tests all came back negative. The cause of death is still undetermined.

Missing Condors

Two free-flying condors and two condor chicks went missing in the wild and were declared dead in 2015. Juvenile condor #628 and adult condor #370 went missing in the wild with last detections via VHF signal on October 22, 2014 and October 30, 2014, respectively. The last visual of condor #628 was on October 21, 2014 at Bitter Creek NWR. Condor #370 was last seen on top of the Bitter Creek flight pen on September 20, 2014. Without the carcasses, the cause of death for both condors remains unknown. Two chicks went missing in the wild, condor #770 and condor #803. Condor #770 was missing from the nest cavity when field team members conducted the 60-day nest entry. No remains were ever located. Condor #803 was in a remote nest that was not entered (see 3.4 Nest Management). The nest was determined to have failed after hatching when the parents stopped attending the nest cavity.

Table 3.3.1: California condor mortalities in 2015. Only one carcass of a free flying condor was located this year. Two are presumed dead because they have been missing in the wild for more than a year. Four condor chicks died while still in the nest and one recently fledged condor is presumed dead based on telemetry signals and observations. One pre-release condor died while still captive from an unknown illness.

Studbook ID	Sex	Hatch Date	Mortality Date	Cause of Death	Location of Death
192	Female	27-May-98	16-Sep-15	Lead toxicosis	Private Inholding in Tejon Canyon on Tejon Ranch
370	Female	22-Apr-05	31-Oct-14	Unknown - missing in the wild	Unknown
628	Female	02-Jun-11	23-Oct-14	Unknown - missing in the wild	Unknown
724	Male	14-Mar-14	16-Sep-15	Undetermined illness	Los Angeles Zoo
770	Unknown	19-Mar-15	19-May-15	Unknown - missing in the wild	Near Hopper Mtn NWR, nest area on private property
778	Male	08-Apr-15	18-Nov-15	Unknown - unrecovered	Near Hopper Mtn NWR, Los Padres NF
779	Unknown	08-Apr-15	15-Apr-15	Undetermined	Near Hopper Mtn NWR, in nest cavity on private property
792	Unknown	05-May-15	13-Aug-15	Euthanized due to suspected rock fall injuries	Los Angeles Zoo
793	Male	04-Apr-15	23-Sep-15	Lead toxicosis	Near Hopper Mtn NWR, below nest area in Los Padres NF
803	Unknown	23-Apr-15	20-Jun-15	Unknown - missing in the wild	Near Hopper Mtn NWR; nest area in Los Padres NF

3.4 Nest Management

The 2015 nesting season started with the earliest lay date in the wild on record, January 21, and ended with the latest fledge date on record, December 17. There were ten nests during the season (Table 3.4.1). This is an increase from 2014, in which there were three active nests. Four of the six known breeding pairs nested, and there were six first time pairs nesting this year. Four of these new pairs formed after its former mate died.

Nesting Success

Nesting success, defined as the total number of chicks to fledge out of the total number of nests, has increased dramatically since nest guarding was implemented across all nests in 2007 (Figure 3.4.1). Five of the ten nests in 2015 had chicks that fledged resulting in 50% nesting success.

Table 3.4.1: Nesting attempts and outcomes for the 2015 breeding season. Sire Studbook Number is the studbook number of the male attending the nest. Dam Studbook Number represents the studbook number of the female attending the nest. Foster Eggs are captive laid eggs used to replace the wild laid egg when it was not viable. 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	Foster Egg Used	Foster Egg Identification	Date Hatch	Chick Studbook Number	Number of Nest Entries	Nest Fate
SP15	25-Feb	247	79	FW115	21-Jan	N	NA	19-Mar	770	3	Failed on 19-May
PC15	8-Feb	237	255	FW215	1-Feb	N	NA	30-Mar	774	3	Fledged on 03-Oct
AB15	20-Feb	21	192	FW315	10-Feb	N	NA	8-Apr	778	5	Fledged on 01-Oct
HC15	27-Feb	107	161	FW415	20-Feb	Y	15CHU01	14-Apr	780	5	Fledged on 22-Oct
OM15	6-Mar	326	518	FW515	10-Feb, 7-Mar	Y	LA615	8-Apr, 1-May	779, 791	6	Fledged on 20-Oct
3C15	13-Mar	365	487	FW615	25-Feb	N	NA	23-Apr	803	0	Failed on 20-Jun
KR15	5-Mar	509	111	FW715	24-Feb	N	NA	22-Apr	793	5	Failed on 23-Sept
RC15	28-Apr	98	289	FW815	6-Mar	N	NA	NA	NA	0	Failed on 2-May
DG15	13-Mar	206	513	FW915	9-Mar	N	NA	5-May	792	3	Failed on 13-Aug
PB15	9-Apr	262	449	FW1015	3-Apr	N	NA	30-May	804	4	Fledged on 17-Dec

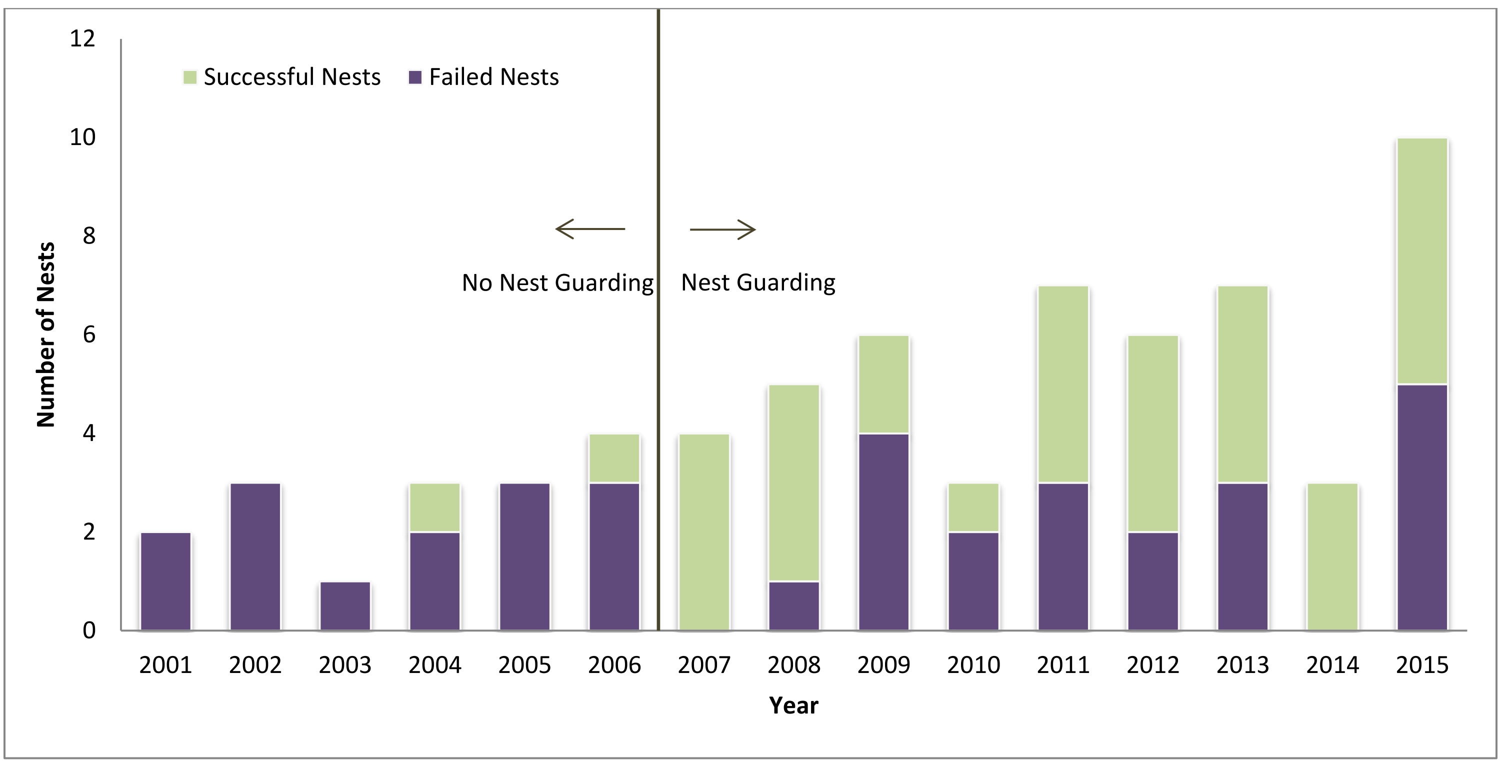


Figure 3.4.1: Nesting success before and after implementation of the Nest Guarding Program. Nests are defined by pairs or trios of condors that produce at least one egg. Nesting success is any nest where a chick fledges from the nest.

Nest Observations

In 2015, nests were observed over the course of the season using direct observation and nest cameras. Nest cameras were used for monitoring three of the nests: KR15, DG15, and PC15. In the case of KR15 and DG15, cameras were installed during the hatch confirmation. The PC15 pair reused their cavity from 2013 which had a camera already installed, requiring only minor adjustment and maintenance.

Chicks and fledglings were directly observed for a total of 962 observation hours taking place over 269 observer days. Unpaid volunteer observer hours accounted for 52% of all observation hours (Table 3.4.2). For nests with cameras, observers spent a portion of two to three days each week reviewing nest camera footage. Observers spent 204 hours reviewing 4,600 hours of video footage.

Table 3.4.2: Nest observation hours by personnel type.

Personnel Type	Observation Hours
Service Staff	21
Santa Barbara Zoo Staff	65
Volunteer Interns	375
Unpaid Volunteers	500
Total Observation Hours	962

Nest Entries

The field team performed 34 nest entries (Photo 3.4.1) over the course of the year. This was over twice as many as the 14 entries the previous year due to the increased number of nests; even given the reduced entry schedule. Each entry required two to four personnel for eight to twelve hours. Santa Barbara Zoo personnel assisted with 24 of these entries, and Los Angeles Zoo staff assisted on 13 nest entries.

Two of the 2015 nests, RC15 and 3C15, were monitored less frequently and not entered due to their remoteness. Both of these failed, one during the egg stage (RC15) and one during the chick stage (3C15).

Photo 3.4.1: Wildlife Biologist, Eddie Owens, descends into condor nest, HC15. *Photo Credit: Joseph Brandt, USFWS.*

DG15 required an additional entry early in the year for hatch confirmation and to fix an issue with the camera connection. Later, after a test stream of the nest had begun broadcasting online, a biologist in the office noticed the chick hadn't been moving as expected. This was unfortunately timed with a brief local power outage that left a gap in archived footage. Further review and close monitoring revealed a need for an emergency nest entry, as the chick did not appear to be able to stand or walk. The chick was evacuated less than 48 hours after the concern first arose. Unfortunately, its injuries were so severe it had to be euthanized after examination at the Los Angeles Zoo and the nest failed.

The OM15 nest required multiple interventions before successfully fledging a chick. Although the pair hatched their own fertile egg, the chick died at seven days of age. The field team responded quickly and placed a dummy egg in the nest that same day. After the pair resumed incubation of the dummy egg, the field team attempted to place an externally pipped egg (an egg where the chick has begun to break through its shell) in to the nest but female #518 did not accept the egg within a reasonable time. This egg was collected within hours of it being placed and was returned to captivity where it hatched. The pair was again given a dummy egg and the male first resumed incubation, followed by the female. Seven days later the field team successfully placed another externally pipped egg in the nest. Male #326 in attendance and he accepted the egg.

Two of the non-camera nests, AB15 and HC15, had a significant amount of microtrash and required an additional 90-day entry to clean the nest of microtrash and examine the chick (Table 3.4.3). The KR15 nest required an additional entry for a quick adjustment to the nest camera equipment, as well as a final entry to recover the carcass of the chick after nest failure.

Table 3.4.3: Microtrash recovered from nests during 2002-2015 seasons. Values represent the total number of trash items collected from each nest or associated chick each year (*Nest failed prior to the chick being 90 days of age, value was not included in the average or nest count).

	Year													
Nest	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
AB	-	-	143	321	1*	233	-	60	-	3*	-	167	-	244
DG	-	-	-	-	-	38	-	52	32*	-	31	-	-	0
GF	-	-	-	-	-	-	-	-	-	0*	-	-	-	-
HB/SP	-	-	-	-	-	-	0	unk*	-	10	1	31	21	15*
HC	20	-	?	-	46	19	26	103	-	55	-	55	-	125
HW	86	-	-	-	-	-	-	-	-	-	-	-	-	-
HW/3C	-	-	-	-	-	-	322	12*	-	-	-	-	-	unk*
KR	0	44	53	41	-	43	11	10*	26	3	9*	153	16	93
LC-PC	53	-	-	-	-	-	-	-	-	-	-	-	-	-
LP	-	-	-	5*	-	-	-	-	-	-	-	-	-	-
OD	-	-	-	-	-	-	-	-	-	-	-	0	-	-
OM	-	-	-	-	-	-	-	-	-	-	-	-	-	45
PB	-	-	-	-	-	-	-	-	-	-	-	-	-	8
PC[1]	-	-	-	-	48	-	115	-	-	-	-	-	-	-
PC[2]	-	-	-	-	-	-	-	-	-	32	-	51	-	12
SC	-	-	-	-	-	-	-	-	-	21	1*	3*	-	-
RC	-	-	-	-	-	-	-	-	-	-	3	-	-	unk*
TC	-	-	-	-	-	-	-	-	-	-	71	-	49	-
Average	40	44	98	184	48	95	95	72	na	24	27	76	29	75

3.5 Captive Releases and Transfers

In 2015, the field team released 11 condors into the wild at Bitter Creek NWR (Table 3.5.1). Releases occurred during the months of October, November, and December. Ten condors were juveniles, released into the wild for the first time, and one condor was re-released into the wild after a 30 year period of captivity. Prior to release, all released condors were held in the flight pen at Bitter Creek NWR for a minimum of six weeks starting in September. An additional condor, #360, was released after spending nearly ten months in rehabilitation at the Los Angeles Zoo from severe lead toxicosis; it was trapped on January 6, 2015.

Transport and Husbandry

In early September, 19 condors were transferred to Bitter Creek NWR from the World Center of Birds of Prey, Los Angeles Zoo, and San Diego Zoo Safari Park for release into the wild. During the four months pre-release condors were housed in the flight pen, the field team checked on their health daily and conducted additional, intensive four-hour observations two to four days a week. While held in captivity, these condors were given regular fresh food and water, which necessitated at least one field team member or volunteer at the Refuge at all times.

Shortly after the prerelease condors were transferred to Bitter Creek NWR, two condors, #724 from San Diego Zoo Safari Park and #726 from World Center of Birds of Prey, were transferred to the Los Angeles Zoo Health Center after they appeared to be ill. Condor #724 died while at the zoo (see Detecting Mortalities for further information). Condor #726 recovered from the unknown illness and was transferred back to Bitter Creek NWR in mid-November.

Of the 18 remaining condors, six were held temporarily at Bitter Creek NWR before being transferred to Ventana Wildlife Society and Pinnacles National Park for eventual release. The other 12 were meant for release at Bitter Creek NWR.

Condor Releases

Releases began at Bitter Creek NWR on October 20, 2015. The first bird to be released was condor #360. He was released into the wild by hand, immediately after being handled to attach both VHF and GPS transmitters. The ten captive bred condors were released in groups of two or three over the next two months (Table 3.5.1). These groups were from the flight pen at Bitter Creek NWR where they could interact with other condors feeding in the area. The final bird released in 2015 was condor #20 (also known as AC4). He was also released from the flight pen at Bitter Creek NWR but was unintendedly flushed from the area by the volunteer operating the door to the release pen and did not interact with any condors before taking his first flight.

Post Release Monitoring

The ten new releases and condor #20 were closely monitored for appropriate feeding and roosting behaviors after release. This monitoring required an average of two people per week for approximately 10 hours per day from October 21 to December 31 (Table 3.5.2). Releasing the birds in smaller groups, rather than all at once, allowed the field team to focus on the behaviors of each group making sure that they exhibited proper roosting and feeding behavior before releasing the next group.

Population Increase

Loss from mortalities and gains from new releases and wild reproduction netted an 18% increase to the Southern California population in 2015 (Figure 3.5.1). Releasing condors contributed the most to the population increase (12%). This increase also surpassed the net population loss that occurred in 2014 when releases did not occur.

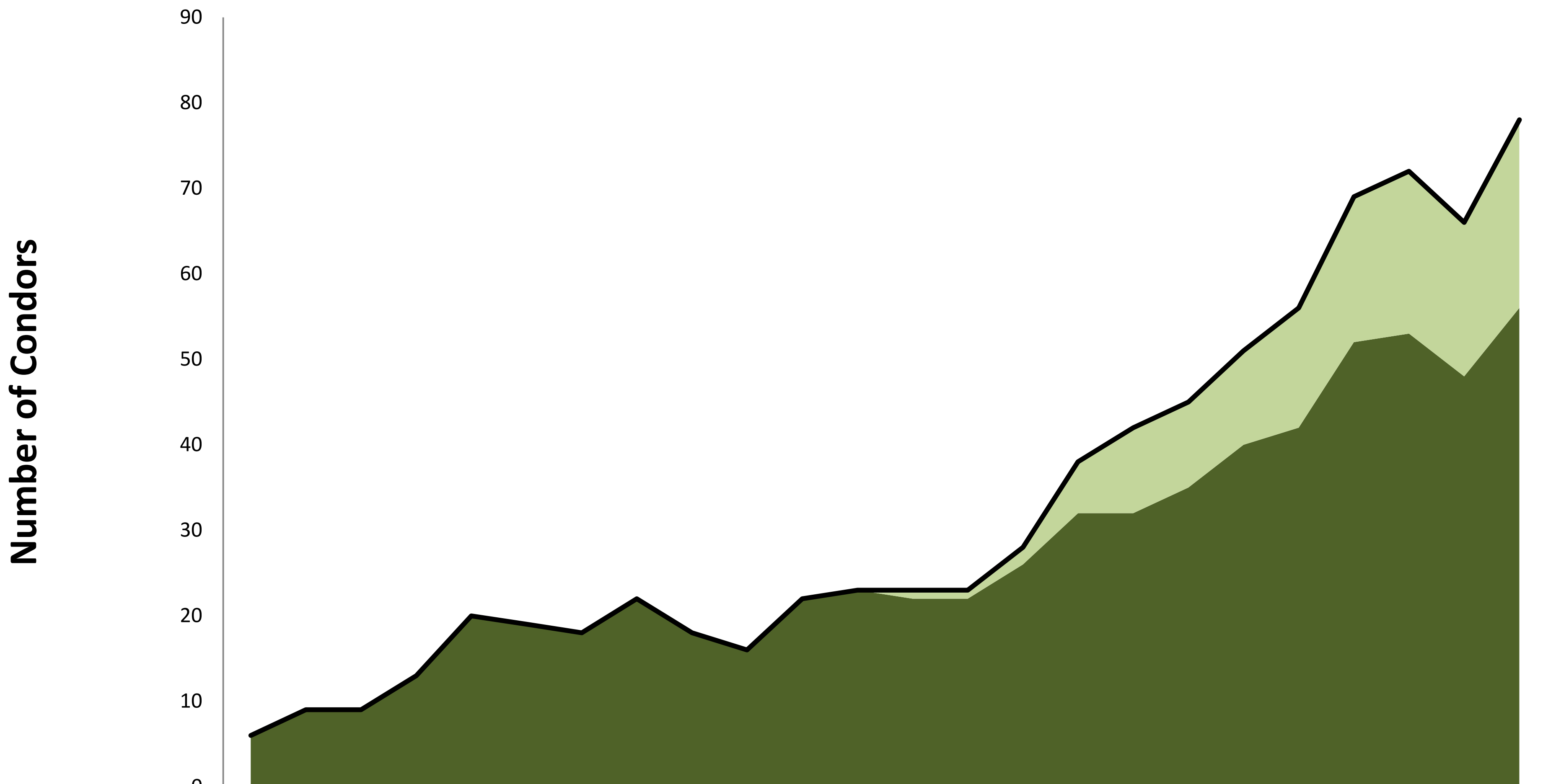
Photo 3.5.1: After 30 years in captivity as a part of the captive breeding program, condor #20 (a.k.a. AC4) is released back into the wild at Bitter Creek NWR. *Photo Credit: John Myatt, USFWS*

Table 3.5.1: Condors released at the Bitter Creek NWR in 2015. SB# = Studbook #; LAZ= Los Angeles Zoo; SDZSP=San Diego Zoo Safari Park; WCBP=World Center for Birds of Prey; NA=not applicable. A successful fate indicates that the released condor was alive and remained in the wild population without having to be recaptured for 90 days following its initial release.

SB#	Sex	Hatch date	Hatch location	Transfer date	Release date	Fate	Age at Release (in years)
730	female	15-Apr-14	WCBP	3-Sep-16	21-Oct-15	Successful	1.5
666	male	25-May-12	WCBP	3-Sep-16	22-Oct-15	Successful	3.4
732	male	16-Apr-14	WCBP	3-Sep-16	11-Nov-15	Successful	1.6
737	female	20-Apr-14	WCBP	3-Sep-16	11-Nov-15	Successful	1.6
740	male	18-Apr-14	WCBP	3-Sep-16	11-Nov-15	Successful	1.6
748	male	29-Apr-14	WCBP	3-Sep-16	3-Dec-15	Successful	1.6
755	male	8-May-14	WCBP	3-Sep-16	3-Dec-15	Successful	1.6
759	male	21-May-14	WCBP	3-Sep-16	3-Dec-15	Successful	1.5
676	female	25-Feb-13	SDZSP	2-Sep-16	16-Dec-15	Successful	2.8
736	female	19-Apr-14	LAZ	2-Sep-16	16-Dec-15	Successful	1.7
20	male	<1-Jan-1980	Wild California	2-Sep-16	29-Dec-15	Successful	>35

Table 3.5.2: Captive release efforts in 2015 at Bitter Creek NWR.

	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	2	3	6
Approximate staff hours tracking new releases	0	0	0	0	0	0	0	0	0	240	600	600
Total number of calf carcasses provided	12	0	0	0	0	9	18	0	0	16	23	19



	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
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
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
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

Figure 3.5.1: Number of wild California condors from 1992 through 2015. The size of the population represents the number of condors in the Southern California flock at the end of each year (Dec 31).

3.6 Behavioral Modification

In 2015, condors visited seven general known areas of human development. Of these, the most frequented areas were the communities of Bear Valley Springs (BVS), Stallion Springs, and Alpine Forest Park in the Northern Tehachapi Mountains and a private inholding on Winter's Ridge of Tejon Ranch. Condors visited the other three developed areas: an oil pad near Lake Piru, ITT Towers on the Angeles National Forest, and a church, Rancho de la Cruz, near Bitter Creek NWR, much less frequently.

Monitoring activities and effort by field team personnel at the communities in the Northern Tehachapi Mountains was similar to 2014. The field team spent about 8 hours each week monitoring and hazing condors from private homes in the communities, educating residents, and providing assistance with automated hazing devices and other deterrents. Guidance was also provided to the communities of BVS and Stallion Springs concerning the modification and covering of their dip tanks to prevent the entrapment and drowning of condors. The field team corresponded directly and frequently with the owners of the inholding on Tejon Ranch, providing both education and technical assistance.

In addition to providing direct assistance to residents and landowners the field team also performed outreach to help address condor habituation concerns. These activities are reported below in section 3.7 Outreach.

3.7 Outreach

In 2015 the field team increased its public outreach efforts in a variety of ways. By creating new partnerships and expanding existing partnerships the field team expanded its presence on social media, initiated new programs and expanded its efforts conducting non-lead outreach.

Condor Cave

Interest in the Condor Cave Facebook page increased with a total of 4,584 followers as of December 31, 2015. This was a 112% increase over the previous year. Since its inception in 2012 the page has more than doubled its number of followers each year. The Santa Barbara Zoo staff plays the primary role in developing the content for this page providing two to three posts a week. Posts include photos, nest camera videos, and updates from the field.

Online Condor Nest Camera

With assistance from the Western Foundation of Vertebrate Zoology, the field team wirelessly transmitted the nest camera's feed about 20 miles where it could be uploaded to the internet and streamed live. This camera went live relatively late in the nesting season but still managed to reach 57,000 unique viewers from 112 countries who watched for over 31,000 hours.

CondorKids

The CondorKids third grade curriculum was piloted by the Fillmore Unified School District during their summer session in 2015. Students were taught many of the classroom lessons and the teachers were able to provide feedback. Students and teachers also took field trips to the Santa Barbara Zoo, Bitter Creek NWR, and Hopper Mountain NWR where they were able to view condors in their natural habitat and interact with many of the field team members. The curriculum and other activities were well received by the 150 students who participated in the program.

Non-Lead Outreach

The Institute for Wildlife Studies' Non-lead Outreach Coordinator for Southern California was involved in 12 outreach activities, often with other field team members, which directly reached over 700 people in southern California. These activities included booths, presentations, shooting demonstrations, and assistance with tours and interviews (Table 3.7.1). Topics included non-lead ammunition, ammunition laws and ballistic performance, the role of hunting in conservation, the effects of lead on condors and other wildlife, and non-lead outreach efforts in California. An additional booth in Northern California for the International Sportsman Exposition directly reached 1,200 people.

Condor 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, Alpine Forest Park Property Owner's Association website. Each community service districts also provided flyers through community newsletters and sent them to residents by mail (Apendix III) .

Other Outreach Activities

The field team led and assisted with seven tours of Hopper NWR and Bitter Creek NWR (Table 3.7.2). The tour recipients included the Fillmore Unified School District test group for CondorKids, British Broadcasting Corporation, Los Angeles Audubon, Native Plant Society, and the general public. The Pasadena Audubon Young Birders were present for the release of condor #20, also known as AC4, back into the wild (see Transfers and Releases section). An additional tour of the Santa Barbara Zoo was provided for the Fillmore Unified School District as part of the CondorKids program.

In addition to the non-lead outreach presentations, there were a number of other presentations and media events in 2015 (Table 3.7.3). A presentation was given as the part of a bird conservation and research seminar series to an ecology class at the University of California Santa Barbara. The presentation described the California Condor Recovery Program as a whole and provided information regarding the management and the conservation of the free-flying condor population in Southern California. A field team member assisted with a screening of the Condor's Shadow at the University California Humboldt in Arcata, California. The event raised awareness in the surrounding communities about the Yurok Tribe's and Redwood National Park's efforts to reintroduce condors to their former range in Northern California. One hundred twenty eight people attended the screening.

The field team responded to media interviews about various aspects of condor conservation and the launch of the live streaming condor nest camera on The Cornell Lab of Ornithology website with KEYT Channel 3 News, National Public Radio, and The Washington Post.

Photo 3.7.1: Non-lead outreach booth set up at the Bakersfield Sportsman's Expo. *Photo credit Russell Kuhlman, Institute for Wildlife Studies*

Table 3.7.1: Non-Lead outreach presentations given in 2015. The Institute for Wildlife Studies (IWS) non-lead outreach coordinator organized and lead these activities with assistance from others on the field team.

Description	Location	Date
IWS Non-lead Outreach Coordinator, Russell Kuhlman, and Wildlife Biologist, Josh Felch, staffed a booth at the Bakersfield Sportsman's Expo	Bakersfield, CA	27-Feb-2015 - 1-Mar-2015
IWS Non-lead Outreach Coordinator, Russell Kuhlman, staffed a booth at Wind Wolves Nature Preserve's Nature Festival	Wind Wolves Nature Preserve, Bakersfield, CA	28-Mar-2015 - 29-Mar2015
IWS Non-lead Outreach Coordinator, Russell Kuhlman, and IWS personnel staffed a booth and performed a shooting demonstration to an advanced hunter education class	Apple Valley, CA	11-Apr-15
IWS Non-lead Outreach Coordinator, Russell Kuhlman, staffed a booth and presented to the Southern California Chapter of the California Deer Association	San Bernardino, CA	30-May-15
IWS Non-lead Outreach Coordinator, Russell Kuhlman, staffed a booth at the Santa Barbara Conservation Exposition	Santa Barbara, CA	30-Jun-15
IWS Non-lead Outreach Coordinator, Russell Kuhlman, staffed a booth and presented to the Winchester Gun Club	Santa Barbara, CA	27-Jul-15
IWS Non-lead Outreach Coordinator, Russell Kuhlman, and Wildlife Biologist, Eddie Owens, staffed a booth and performed a non-lead shooting demonstration for the Ojai Valley Gun Club	Ojai, CA	29-Aug-15
IWS Non-lead Outreach Coordinator, Russell Kuhlman, staffed a booth at the Santa Barbara Zoo's Vulture Day.	Santa Barbara, CA	6-Sep-15
IWS Non-lead Outreach Coordinator, Russell Kuhlman, staffed a booth and presented at the Mojave Youth Hunt	Mojave, CA	3-Oct-15
IWS Non-lead Outreach Coordinator Russell Kuhlman staffed a booth at the Seneca Oil Company interagency BBQ	Fillmore, CA	7-Oct-15
IWS Non-lead Outreach Coordinator, Russell Kuhlman, gave presentation at the Southern California Department of Fish and Wildlife Commissioners' meeting	La Canada, CA	6-Nov-15

Table 3.7.2: Outreach tours performed in 2015. BCNWR=Bitter Creek NWR, HMNWR=Hopper Mountain NWR, UCSB=University of California Santa Barbara, FCCWF=Friends of the California Condor Wild and Free, SBZ=Santa Barbara Zoo, BBC=British Broadcasting Corporation, GBI=Great Basin Institute, FUSD=Fillmore Unified School District.

Description	Location	Date
SBZ Conservation Research Associate, Devon Pryor, and SBZ Condor Nest Technician, Nadya Seal Faith, led a tour of BCNWR for CondorKids FUSD test group	Bitter Creek NWR	11-Feb-15
SBZ Director of Conservation and research, Estelle Sandhaus, SBZ Condor Nest Technician, Nadya Seal Faith, and IWS Non-lead Outreach Coordinator, Russell Kuhlman, assisted with tour of HMNWR and did an interview for BBC	Hopper Mountain NWR	1-Apr-15
SBZ Director of Conservation and Research, Estelle Sandhaus, SBZ Conservation Research Associate, Devon Pryor, SBZ Condor Nest Technician, Nadya Seal, and Supervisory Wildlife Biologist, Joseph Brandt, assisted with a tour of Santa Barbara Zoo for CondorKids FUSD test group	Santa Barbara Zoo	14-Jul-15
Supervisory Wildlife Biologist, Joseph Brandt, SBZ Conservation Research Associate, Devon Pryor, and GBI Research Associate, Stephanie Herrera, led a tour of HMNWR for the CondorKids FUSD test group with assistance from USFWS Ecological Services personnel	Hopper Mountain NWR	4-Aug-15
Wildlife Biologist, Josh Felch, assisted with FWCCWF tour of HMNWR for the general public	Hopper Mountain NWR	17-Oct-15
Supervisory Wildlife Biologist, Joseph Brandt, led a tour of BCNWR for Los Angeles Audubon	Bitter Creek NWR	31-Oct-15
Wildlife Biologist, Eddie Owens, Biological Science Technician, Molly Astell, and GBI Research Associate, Alyssa Davidge, led a tour of BCNWR for the Native Plant Society	Bitter Creek NWR	21-Nov-15
Supervisory Wildlife Biologist, Joseph Brandt, Project Leader, Mike Brady, California Condor Field Coordinator, Steve Kirkland, Wildlife Biologist, Josh Felch, Wildlife Biologist, Eddie Owens, Office Assistant, Marina Martinez, SBZ Conservation Research Associate, Devon Pryor, and GBI Research Associate, Alyssa Davidge, led in the condor AC4 release event with assistance from USFWS Public Affairs, former California Condor Recovery Program personnel, and volunteers with Pasadena Audubon Young Birders Group in attendance	Bitter Creek NWR	29-Dec-15

Table 3.7.3: Outreach presentations given in 2015. FCCWF=Friends of the California Condor Wild and Free, HMNWRC=Hopper Mountain National Wildlife Complex, IWS=Institute for Wildlife Studies, SBZ=Santa Barbara Zoo, VWS=Ventana Wildlife Society, UCSB=University of California Santa Barbara.

Description	Location	Date
Wildlife Biologist, Josh Felch, gave a presentation as part of a bird conservation and research seminar series for a UCSB ecology class	University of Santa Barbara, Santa Barbara, CA	20-Apr-15
Supervisory Wildlife Biologist, Joseph Brandt, assisted with screening of the Condor's Shadow for the Yurok Tribe	Arcata, CA	24-Apr-15
Supervisory Wildlife Biologist, Joseph Brandt, interviewed with KEYT Channel 3 News and NPR after a press release announcing the live stream for the condor nest camera on The Cornell Lab of Ornithology website	Ventura, CA	26-Aug-15
Supervisory Wildlife Biologist, Joseph Brandt, Project Leader, Mike Brady, SBZ Director of Conservation and Research, Estelle Sandhaus, SBZ Conservation Research Associate, Devon Pryor, SBZ Condor Biologist, Molly Astell, and SBZ Condor Nest Technician, Nadya Seal Faith, debuted the live stream of the condor nest camera for CondorKids FUSD test group with assistance from USFWS Ecological Services and SBZ personnel	Mountain Vista Elementary School, Fillmore, CA	27-Aug-15
Supervisory Wildlife Biologist, Joseph Brandt, interviewed with the Washington Post for story on the live streaming condor nest camera	Ventura, CA	28-Aug-15

4.0 Discussion

Staffing

The field team went through a number of changes in 2015. The two Service term wildlife biologist positions that were vacant at the end of 2014 were filled. One of these positions was filled by Josh Felch who was in the term biological science technician position at the Complex. The other came from outside the program. The biological science technician position that was left vacant was filled later in the year. The Santa Barbara Zoo brought on a new condor nesting technician and condor biologist who both are very valuable members of the field team. Filling the vacant positions and having the support of additional Santa Barbara Zoo positions helped the field team rebuild much of the capacity that was lost in 2014. A new staff requires some time to train and create cohesion among the team but this is taking much less time than anticipated.

Monitoring Resource Use

The field team used two manufacturers of GSM/CDMA GPS transmitters, and there was some indication that there is a difference in performance and reliability between the two. In order to get a better assessment of the unit performance the field team began to track how often each unit transmited and the overall life of each transmitter deployed. It is important to use the most reliable and longest lived transmitters due to the increased difficulty with trapping condors annually, because many condors will go longer without being trapped.

Lead Monitoring and Mitigation

The field team trapped a smaller proportion of the condor population in 2014. This is the third consecutive year that the trapped proportion of the population has gotten smaller. Only 61% of the population was trapped in 2015 compared to 90% in 2014. As the condor population expands in range, individual condors spend less time near trap sites and become more difficult to trap.

Discussions of an additional trap site in the Tehachapi Mountains started in 2015 but a site has yet to be selected. A new trap site central to where condors are most active in their range will likely improve the field team's ability to trap condors but will also present logistical challenges by being located roughly 45 miles from either Bitter Creek NWR or Hopper Mountain NWR.

The field team also considered increasing the period of time they attempt to trap the population as a way to increase the number of condors trapped.

Nest Management

In 2015, the field team reduced the number of scheduled nest entries from four to two during the chick stage of the nest. The three nests with nest cameras were entered once during the chick stage. Two nest were also not entered at all due to their remote location. In total, 34 nest entries were performed in 2015 if the prior years' nest entry schedule was used nests would have been entered a minimum of 58 times.

The results of reducing the number of nest entries were promising. Fifty percent of the nests still fledged chicks and at least for two nests it is unlikely that additional nest entries would have changed the outcome. The cause of failure for the other three nests is unknown and it is unclear whether additional nest entries would have prevented failure.

Outreach

The field team has used partnerships and technology to expand their capacity for education and outreach. With two new projects, an online live streaming condor nest camera and CondorKids Online Curriculum, the need for a dedicated Education and Outreach position is essential to ensure these projects reach their national potential. This is especially true for CondorKids which has the ability to expand in many other large local urban centers such as Los Angles and Santa Barbara and the potential to be used by teachers nationwide.

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Appendix I: Contributions to Ongoing Research

Data collected over the course of 2015 will contribute to ongoing research within the Service, various universities, and other federal agencies. Examples of this ongoing research include:

California condor flight response in a variable meteorological and topographic environment
Years: 2014-2018

Study Objective: The objective of this study is to record movements of California condors to understand how their flight behavior (especially altitude above ground level) responds to variation in topography and weather. Previous work with other species suggests that flight altitude is strongly influenced by these parameters and the type of subsidized lift the bird is using. Information on condor flight behavior will be used to (a) predict risk to birds from existing and proposed individual turbines within existing condor range; and (b) predict risk to birds from existing and proposed turbines within the projected (and expanded) future range of condors (c) identify wind and/or topographic variables that may be preferentially used by condors.

Principal Researchers: Todd Katzner and Sharon Poessel from USGS Forest and Rangeland Ecosystem Science Center; Johnathan Hall and Melissa Braham from WVU.

Sponsor: California condor subaccount under the Renewable Energy Action Team Mitigation Account Memorandum of Agreement between the Renewable Energy Action Team Agencies and the National Fish and Wildlife Foundation. Funding is the result of contributions made by Alta Windpower Development, LLC as part of the avoidance, minimization, and mitigation program for the California condor (Gymnogyps californianus) that was identified in the Bureau of Land Management's final environmental impact statement (Bureau 2013) and the biological opinion (U.S. Fish and Wildlife Service [Service 2013a]) for the Alta East wind energy project.

Anticipated Completion: 2018

Species Tracking Optimization: Pilot Test of an Improved Capture and Delivery of California Condor Location Information
Years: 2013-2016

Study Objective: Alternatives for monitoring wildlife populations now exist that can significantly improve wildlife monitoring and management. Projects have the potential to track and alert wildlife mortality in near real time, track sick or injured wildlife, implement location-aware alerts (termed geofencing), and enable users to access these data though traditional desktop computing and mobile environments (e.g. smartphones). This proposal is investigating new and emerging technologies that will improve condor science and management.

Principal Researchers: David Douglas, Robert Waltermire, Tim Kern, and Chris Emmerich from USGS; Gil Bohrer, Rolf Weinzerl, and Sarah Davidson from Movebank.org; Richard Kearney, Pat Lineback, Joseph Brandt, and Laura Mendenhall from USFWS; Andrew McGann from Cellular Tracking Technologies, LLC.

Sponsor: U.S. Fish and Wildlife Service, U.S. Geological Survey, Movebank.org

Funding Source: Science Support Partnership Fund

Results to Date: Development of a new GPS data model; manufacture of a custom GSM unit; progress on establishing a condor daily map using data from FISMA-compliant repository.

Anticipated Completion: January 2016

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.

Sponsor: U.S. Fish and Wildlife Service California Condor Recovery Program, San Diego Zoo Global.

Funding Source: San Diego Zoo Global, Seaver Institute, John and Beverley Stauffer Foundation, other private foundations.

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.

An assessment of the biological impact of contaminants and management actions that influence the long-term persistence of the California condor
Years: 2011-2016

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: 2016

Eggshell thinning and depressed hatching success of California condors reintroduced to Central California.
Years: 2006-2017

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: 2017

California condor Nest Guarding Project
Years: 2007- 2016

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.

Anticipated completion: 2016

Appendix II: Hopper Mountain National Wildlife Refuge Complex Remote Telemetry Condor Detection System

U.S. Fish and Wildlife Services
2015

Prepared By:

Eddie Owens
Wildlife Biologist
&
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Biological Science Technician

Background

Knowledge of California condor movements and habitat use is essential to condor recovery. Location information is regularly used to assess the risk of proposed developments (e.g., wind projects), identify nesting sites, and to identify and respond to sick, injured, or dead birds. Understanding the cause of mortality is critical. While wing mounted GPS technology has been instrumental in determining trends in habitat use, it is not suitable for many day-to-day management actions. Location data acquired from GPS is infrequent and data are typically not available until the day after they are collected. It is for these reasons that, since 1992 when the first condors were released, biologists have relied on VHF transmitter technology (telemetry) to guide their management actions.

Although VHF telemetry technology has provided managers and biologists with real-time information on condor presence/absence and coarse movements, the data acquisition process has significant limitations. Biologists with hand-held and vehicle mounted telemetry units must hike or drive long distances to successfully track condors from positions of high elevation that provide maximum coverage, and are limited by time and funding in the data they can collect and the area that can be covered. As the condor population grows, becomes more widely dispersed, increases its use of difficult-to-access lands, and extends its range farther to the north and west, biologists' capacity to track movements of this far-ranging species with handheld and vehicle mounted telemetry units will be more logistically challenging, hazardous, and expensive.

In late 2014 the recovery team ordered two Advanced Telemetry Systems (ATS) remote telemetry stations in an effort to improve condor monitoring in remote locations. Each remote telemetry station is capable of real-time detecting and recording of condors with an attached transmitter within range of the unit. Data from each station can then be sent to biologists via satellite transmission on a predetermined schedule. The stations are powered with solar panels and deep-cycle batteries that can operate independently without maintenance for several months. Data collected includes information on radio tag frequencies, time, date, signal strength, and direction.

To test the capabilities of the remote telemetry stations, the condor field team installed one of the units at Bitter Creek National Wildlife Refuge in June 2015.

Description

The condor field team purchased the remote telemetry stations from ATS and paid approximately $20,000 for both units (Table 1); however, it is worth noting that the cost and type of equipment needed is continually changing. In addition to the ATS telemetry package, our setup required eight 15ft RG58 coaxial cables, one action-packer storage box, and six t-posts.

Table 1. Cost of ATS remote telemetry stations at the time of purchase.

Product #	Item Description	Qty	Comments	Cost
Telemetry Station				
R4500S	Standard Receiver-Datalogger	1		$5800
PN13588	Antenna Mounting Kit	4	1 for each yagi	$55
13865	Yagi Antenna	4	$150 each	$600
11606	RG58 Coax Cable-5ft	4		$25
14261	Preamp control cable-1m	1	Included	0
12103	RG58 Coax Cable-1.5ft	1	Included	0
RDP1000	Wireless Comm cell modem	1		$2495
14219	Ant Switchbox (4-way)	1		$325
14646	Ext Power Cord	1	Included	0
15054	Universal Battery Charger	1	Included	0
15141	Battery Charger Cord	1	Included	0
14975	65W Solar Panel Package	1		$675
	Shipping and Handling			15
		Unit Total		**$9820**
		Software		**$950**
		Number of Stations		2
		Total Cost		**$20930**

Installation

After researching several different ways to setup the remote telemetry stations, the condor field team decided the first unit would be installed using a mast anchored by a t-post with the yagi antenna's fixed in the directions of true north, east, south, and west. The action packer housed all of the components (Picture 1) except for the RDP1000, which requires a clear view of the sky to transmit data. We drilled a hole in the side of the action packer to allow all cords to run from the outside components (e.g. coaxial cables) to the inside components. The solar unit was attached to four t-posts and placed for optimal sun exposure at approximately a 45° angle, facing south. An additional t-post anchored next to the solar panel supported the RDP1000 (Picture 2). The initial installation took approximately two hours to complete and involved three personnel. We initially set up the remote telemetry station at the Pit Trap Feeding Site, and after several weeks of testing it, we relocated the station to Hill Top Observation Point.

Picture 1. Action packer with stored components

The ATS package included software which was necessary for accessing the data, however the RDP1000 required additional software available through the ATS web page. Both required assistance from ATS due to not being properly programmed prior to issuance, as well as special administrative rights to download the software and to install the USB driver. This software is the only way in which the user can change settings on both the receiver and the RDP1000, including scan times, black-out dates, and pulse rates.

Picture 2. RDP1000 and supporting t-post

System Settings

There are multiple settings for scanning frequencies. We programmed the unit installed on Bitter Creek National Wildlife Refuge to scan for both a normal and mortality signals. Holohil transmitters provided the appropriate pulse rate for the transmitters, and we used double the normal pulse rate to detect mortality signals. The remote telemetry stations have the ability to scan continuously or periodically for up to four different pulse rates, plus or minus 10. The receiver was programmed to continuously scan, cycling through each frequency every 10 seconds. When a frequency was detected, it would continue to monitor it until there was a three second timeout or after 60 seconds and then switch to the next frequency. The store rate for the receiver allows the user to determine the number of individual records that will be generated within a scheduled increment of time. The station set up at Bitter Creek NWR was set to 60 minutes, meaning that a single record should be generated for each frequency detected every hour. The record includes the specific information for the strongest detection that occurred within that hour and the number of times that frequency was detected. Another important setting is the transfer rate on the RDP. This determines how often the RDP uploads data to a satellite which then transmits that data once a day. The default setting for the RDP was to upload data for 20 seconds every hour.

Data

Data downloaded directly from the unit (Table 2) were packaged differently than data emailed using the RDP1000 (Table 3). The data was retrieved in both methods as a .csv file of relatively small size. Data from in these two formats are then manually added (cut and pasted) to an excel spreadsheet which assigns a condor studbook number to each detection based on the frequency of the transmitter that was being worn by the condor (Table 4). The studbook numbers are assigned in Excel using the IF function.

Table 2. Example of data downloaded from unit using a USB cord.

	A	B	C	D	E	F	G	H
1	Date	Ant	Fr	Sig	NumPls	PR	NumMatc	PrmNum
2	5/23/2015 3:54	0	164229	109	5	36	4	0
3	5/23/2015 16:20	0	163033	137	34	37	23	0
4	5/23/2015 17:42	0	163033	133	40	37	26	0
5	5/23/2015 17:43	4	163033	129	9	37	9	0
6	5/23/2015 17:42	1	163033	132	7	37	6	0
7	5/23/2015 19:30	0	163033	122	17	37	16	0
8	5/23/2015 19:53	2	163033	122	15	37	14	0
9	5/23/2015 21:52	1	163033	119	8	37	6	0

Table 3. Example of data emailed using the RDP1000

	A	B	C	D	E	F	G	H	I	J
1	14004 244/16:00 13.4 RUDICS 163s Fixed:2-15									
2	Day/Hr:Mi	Volts	Log Type	Freq	Pulse Rate	Ant#	Signal	#Matches	Noise Ind.	Hr:Min
3	244/16:00	13.4	Fixed-5	163244	36	0	146	5	0	16:07
4	244/16:00	13.4	Fixed-5	163244	36	3	131	5	0	16:07
5	244/16:00	13.4	Fixed-5	163345	35	3	130	4	0	16:22
6	244/16:00	13.4	Fixed-5	163244	37	3	134	5	0	16:28
7	END 0									

Table 4. Excel spreadsheet created to read and store offloaded data.

	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	Date	Julian Date	Year	Day	Freq	Pulse Rate	Ant#	Signal	Hr:Min	Formula	Formula	STB	Mortality	Station ID
2	6/29/2015	15180	15	180	163033	37	0	154	19:12	216	FALSE	216	No	BC
3	6/29/2015	15180	15	180	163033	37	1	142	19:12	216	FALSE	216	No	BC
4	6/29/2015	15180	15	180	163033	37	2	143	19:34	216	FALSE	216	No	BC
5	6/29/2015	15180	15	180	163033	37	3	155	19:34	216	FALSE	216	No	BC
6	6/29/2015	15180	15	180	163032	37	0	151	19:37	216	FALSE	216	No	BC
7	6/29/2015	15180	15	180	163032	37	3	150	19:37	216	FALSE	216	No	BC
8	6/29/2015	15180	15	180	163033	37	0	149	20:07	216	FALSE	216	No	BC

Discussion

While much was learned in testing the remote telemetry station there are still a number of issues that need to be resolved in order for the system to be considered fully functional and appropriate for set up in a more remote setting.

We discovered several issues with data management. These included the format in which the data was received via satellite and in success of data transmission. First, although data taken directly from the receivers had the date properly formatted, those received through email contained an improper Julian date. We corrected this in the spreadsheet by adding the additional information needed and creating a formula. Another issue with the data packaging is that the date and time were in the same cell; an issue easily addressed by using the Text-To-Columns function in Excel. One of the more challenging aspects of the data formats were breaks in data where unnecessary text was inserted between the rows. The text had no use and was a nuisance. These issues could be more comprehensively addressed by working with a programmer to develop parsing software that can automatically read files that are received via email, convert these data to the appropriate format and then append into a spreadsheet where all detection records are stored. The second issue with data management was that data was often received as an incomplete file via e-mail, or not received. Although the receiver had properly recorded and stored, a large portion of the data was not sent to us regularly in a daily e-mail. While troubleshooting with some assistance from ATS, it appeared that due to the quantity of data being collected, a large portion of the data was not being transmitted due to the data becoming backed up in the transmission process. This issue might be rectified by changing the transmission rates on the RDP so that it sends data to a satellite less often but with a longer period of time allotted for each transmission and/or by adjusting the store rate to reduce the number of records that need to be transmitted.

The cost of transmitting data from each telemetry station was grossly underestimated. Based on pre-setup estimates data fees were expected to be about $125 per month for each station. After operating for about 8 months the average cost was $520 a month. This cost was far more expensive and without decreasing the cost of data transmission the field team would need to periodically visit each station to manually download the data collected. This greatly diminishes the value of these stations when placed in remote or distant locations. As a result of higher-than-anticipated costs, the data services were discontinued. Working with ATS to identify and address problems has been difficult to due to lack of responsiveness. We are currently working with the company to better understand how we might decrease data transmission costs. A possible solution would be again to adjust the transmission rates on the RDP so that it sends data to a satellite less often but with a longer period of time allotted for each transmission and by reducing the number of records by increasing the store rate.

The condor field team found the system settings to be adequate when searching for the Southern California condor population; however, when all of the frequencies from the Central California flock was added, the scan time became too long and birds were being missed by the unit. The scan rates could be adjusted to account for the additional scan time or multiple receivers could be used simultaneously to allow for the current scan rates.

Appendix III: Flyer 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