Pinnacles National Park
California Condor Reestablishment Program
Annual Report 2023

Pinnacles National Park Report

Submitted to United States Fish and Wildlife Service and California Department of Fish and Wildlife

Federal Endangered Species Recovery Permit TE157291-3

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Prepared by:

Alacia Welch, Condor Program Manager
Erin Lehnert, Condor Field Crew Leader
Kaitlin Lopez, Condor Crew Member
Daniel Ryan, Invasive Wildlife Biologist/Non-Lead Ammunition Specialist

National Park Service
Pinnacles National Park
5000 East Entrance Road
Paicines, CA 95043

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ALACIA WELCH
Digitally signed by ALACIA WELCH
Date: 2024.01.30 14:02:41 -08'00'

Alacia Welch, Condor Program Manager

Cover photo: A condor perches on a rock at Pinnacles National Park with its wings open and sun rays beam down from above. NPS/Idangie Sein

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California condor recovery would be impossible without strong partnerships, and we gratefully recognize our collaborators here:

- Every Pinnacles National Park employee that helps support our operations and communicates with the public throughout the year.
- Our interns and volunteers that are amazingly dedicated and keep coming back.
- Ventana Wildlife Society for being a strong and engaged partner in managing the central California flock of condors.
- The veterinarians and keepers at Oakland Zoo, Los Angeles Zoo and the Avian and Exotic Clinic of the Monterey Peninsula for providing such amazing care to every condor that comes their way.
- Our partners operating condor release sites: U.S. Fish and Wildlife Service, Ventana Wildlife Society, the Yurok Tribe, The Peregrine Fund, and Parque Nacional Sierra de San Pedro Mártir.
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- LightHawk staff and their volunteers who donate their time, airplanes, and fuel to fly condors between sites and search for missing condors.
- Agency partners at California Department of Fish and Wildlife, Bureau of Land Management, and U.S. Forest Service for their support.

2023 Pinnacles National Park Condor Program Staff

Volunteers

Christina Baal, Mike Baird, Joseph Belli, Dan Brogden, Lucy Godkin, Tara Johnson, Denise Lopez, Jen Nagel, Rin O'Connell, Bob Quaid, Jeff Robinson, Robbie Sonniksen, Terri Sonniksen, and Darryl Zimmerman

Interns

Kaitlin Lopez, Rafael Perez, and Idangie Sein

Employees

Alacia Welch – Program Manager
Rose Fielding – Field Crew Leader
Erin Lehnert – Field Crew Leader
Gavin Emmons – Raptor/Condor Biologist
Daniel Ryan – Invasive Wildlife Biologist/Non-Lead Ammunition Specialist

INTRODUCTION

California condors are one of the rarest bird species in the world and biologists have been committed to their recovery for over 50 years. The Condor Reestablishment Program ("Condor Program") at Pinnacles National Park (PINN or "Pinnacles") has several objectives with the ultimate goal of species recovery in the wild:

- monitoring central California condor population trends by documenting foraging, movements, nesting, and reproductive success
- detecting mortalities and recovering condor carcasses to determine causes of death
- reducing anthropogenic threats to condors
- increasing public awareness about condor recovery
- collaborating with other agencies and organizations on research to improve condor survival

Together with Ventana Wildlife Society (VWS), PINN manages a flock of 100 condors in central California. During 2023, PINN monitored all birds using the central California area, as well as PINN-managed condors that traveled beyond their typical range. PINN-managed condors and VWS-managed condors make up a single flock, overlap in range, feed together, and are captured at release sites managed by both organizations. This report focuses on PINN Condor Program management of birds released from the park but also includes some VWS-managed condor data, courtesy of VWS.

Many measures implemented in response to the COVID-19 pandemic were discontinued in 2023, but biosecurity protocols developed in 2022 for highly pathogenic avian influenza (HPAI) continued to be followed. These protocols maximize bird and human safety, allowing management of condors to continue while also taking into consideration the threat of HPAI. In March and April 2023, an outbreak of HPAI killed 21 condors in Arizona and Utah. This incident prompted increased collaboration between all condor managers and brought in new partners to address this threat. In May, the U.S. Department of Agriculture (USDA) issued an emergency authorization approving the use of an avian influenza vaccine for condors. After clinical trials in black vultures and captive condors, the U.S. Fish and Wildlife Service (USFWS) advised that all wild and captive condors receive the vaccine. Pinnacles began the process required to vaccinate condors and aims to start vaccinating the wild flock in 2024.

2023 marked the 20-year anniversary of the Pinnacles National Park Condor Reestablishment Program. Highlights from the year include:

- Two condors fledged from nests at PINN - only the second year in the history of the program that this occurred.
- Biologists installed a nest video camera and witnessed the egg hatching, observed a health concern on the nestling that could be monitored without intervention, and watched the young condor grow until it fledged.
- PINN staff organized the first interagency technical ropes training with USFWS and Santa Barbara Zoo since February 2020.
- During a routine capture, one condor was found to have six small shotgun pellets embedded in multiple feathers and under the skin on his jaw.
- Three PINN-managed free-flying condors died. Two of those deaths were attributed to lead toxicosis, which continues to be the leading cause of death for the species.

- The central California flock pushed the northern boundary of the core range further into Santa Clara County than ever before.
- A group of six condors flew as far north as Mount Diablo State Park and soared over the Altamont wind energy development area without incident.
- Condor 1027 joined the USFWS-managed condors in southern California at Bittercreek National Wildlife Refuge and Hopper Mountain National Wildlife Refuge.
- All condors captured at PINN were sampled for avian influenza and there were no positive cases.

METHODS

Population Monitoring

Condors are monitored year-round to document reproduction, mortality, and movements. Condor health, foraging, flock interactions, and breeding behavior are documented through visual observations. Biologists use the following equipment to monitor condors:

- Radio-telemetry receiver: Communication Specialists, Inc. Model R-1000
- Yagi antenna: AF Andronicus, Inc. Model F165-3FB and Model F164-165-3FB
- Omnidirectional antenna, magnetic mount: PCTEL
- Handheld GPS: Garmin InReach GPSMAP661, Garmin etrex Vista HCx, Trimble Juno SB
- GPS transceiver: Microwave Telemetry 45g Argos/GPS solar PTT-100 (Figure 1)
- GSM transceiver: Microwave Telemetry 50g GPS solar GSM 20-70 transmitter and Cellular Tracking Technologies 55g or 40g GPS solar CTT-ES400W transmitter
- Tail mount VHF transmitters: Holohil Model RI-2CM(12) and Advanced Telemetry Systems (ATS) Model A4650
- Patagial mount VHF radio transmitter: ATS "micro" Model A5510 (Figure 2)
- Patagial mount solar VHF transmitter: Merlin Systems, Inc. Model “Condor Wingmount”
- Remote video cameras: AXIS Communications P5655-E PTZ, P5515-E PTZ, and P3346-VE
- Remote trail camera: Reconyx, Inc. HF2X Hyperfire 2

Figure 1, left, Microwave Telemetry 45g Argos/GPS unit on a condor. NPS/Kaitlin Lopez

Figure 2, right, Advanced Telemetry Systems "micro” patagial mount VHF transmitter on a condor. NPS/Kaitlin Lopez

Survival Monitoring

Pinnacles biologists monitor the condor population using radio transmitters and GPS transceivers, or "GPS tags" (Figures 1 and 2). Radio transmitters are detected in the field with an antenna and handheld receiver while GPS tag data is reviewed on a computer. Argos satellite GPS data are downloaded from Woods Hole Group and mapped in ESRI ArcGIS Pro version 3.0.3. Pinnacles also deploys GSM (cellular technology) GPS tags manufactured by Microwave Telemetry (MT) and Cellular Tracking Technologies (CTT). Data from MT and CTT GSM tags are received when a tagged condor flies within range of a cellular tower during a set time frame each day. Location data from all types of GPS tags are available to PINN staff through Movebank's online interface and an online database called CACO Central. Biologists use ArcGIS and Google Earth to map and view all condor location data daily. Pinnacles uses a greater proportion of Argos satellite tags compared to GSM tags due to poor cellular coverage in the central California condor range.

Radio tracking within and around PINN is conducted five to seven days per week. Biologists track at higher elevations to increase probability of detecting signals. Monitoring outside of the park is conducted along public roads in San Benito County, portions of western Fresno County, northern San Luis Obispo County, southern Santa Clara County, and eastern to southern Monterey County. All field data is recorded in Microsoft Access databases. Additionally, summary data of daily monitoring activities are entered into a secure online database, CACO Central, that can be shared with research and agency cooperators with permission.

Biologists closely monitor any condor behaving abnormally and any bird with a GPS tag that does not move in over 48 hours to determine if the individual is injured or sick. When a mortality signal (triggered by a radio transmitter that is immobile for at least four to ten hours, depending on manufacturer) is detected, biologists attempt to locate the transmitter as quickly as possible to confirm a dropped tag or a sick or deceased condor. This activity takes priority above most others to maximize the chance of treating a sick or injured bird or retrieving a carcass before it decomposes significantly. Pinnacles biologists follow condor carcass collection procedures developed by USFWS.

Trapping

Pinnacles staff capture condors to measure blood lead levels, replace transmitters, and collect blood and feather samples for ongoing research studies. Trapping condors is critical to maintain vinyl identification tags and functioning radio transmitters and GPS tags on as many individuals as possible. All data related to each condor handling is recorded in a Microsoft Access database and in CACO Central.

Before handling condors, biologists receive extensive training in handling protocols and sample collection methods from highly experienced staff already listed on PINN's USFWS recovery permit as approved handlers and zookeepers that manage captive condors. Personal protective equipment (PPE) during handling includes eye protection, long-sleeved shirts and pants, closed-toe boots, and leather gloves.

The following biosecurity measures are followed when HPAI is a concern (Figure 3):

- Wear coveralls or bring a separate set of clothes to change into immediately after handling condors or entering areas condors frequent.
- Wear an N95 mask (if indoors), eye protection, and leather gloves when holding condors.
- Wear an N95 mask (if indoors), eye protection, and nitrile or latex gloves when drawing blood, replacing transmitters, or otherwise touching condors.

- After handling condors or being in areas condors regularly frequent, use disinfectant solution rated by the Environmental Protection Agency (EPA) as effective against HPAI to clean the soles of boots and spray all leather gloves that were worn.
- Wear a disposable KN95 or better mask and vinyl gloves when swapping out carcasses at bait sites or condor pen. Clean gloves and boots with EPA-approved disinfectant afterward.

Figure 3, Two PINN biologists in PPE hold Condor 330 while a third biologist prepares to draw blood. NPS/Alacia Welch

Nest Monitoring and Reproduction

Pinnacles and VWS manage nests based on geographic location and ease of monitoring as opposed to who manages the adult condors. In general, nests east of the Salinas Valley are managed by PINN and VWS manages those to the west.

Biologists monitor active nest sites from observation points located 300-800 meters away depending on topography. They look for egg incubation, hatching, nestling health, behavioral interactions, adult-nestling feeding events, and fledging of young. Where feasible, PINN staff enter active nests following standard procedures for nestling health checks, conducted at 45-60 and 120 days of age. Access to nests on private property, nest location, parent and nestling behavior or health, and staff capacity may result in changes to planned nest entries to ensure safety for entry participants as well as condors.

During nest entries, PPE includes all appropriate climbing equipment, eye protection, respirators, and leather and nitrile gloves. Biologists and/or a veterinarian check a nestling's blood lead level, general health, and administer a West Nile Virus vaccination (Figure 4). If a nestling has high lead exposure, it may be evacuated from the nest for emergency care or monitored more closely. Biologists search nest substrates for eggshell fragments and trash, which are removed when found. Annual nest entry trainings are conducted at PINN and additional technical ropes trainings occur year-round to maintain staff experience with relevant technical skills (Figure 5).

Figure 4, Amy Wells, DVM, draws blood from nestling Condor 1229 while a PINN biologist gently restrains the bird. NPS/Alacia Welch

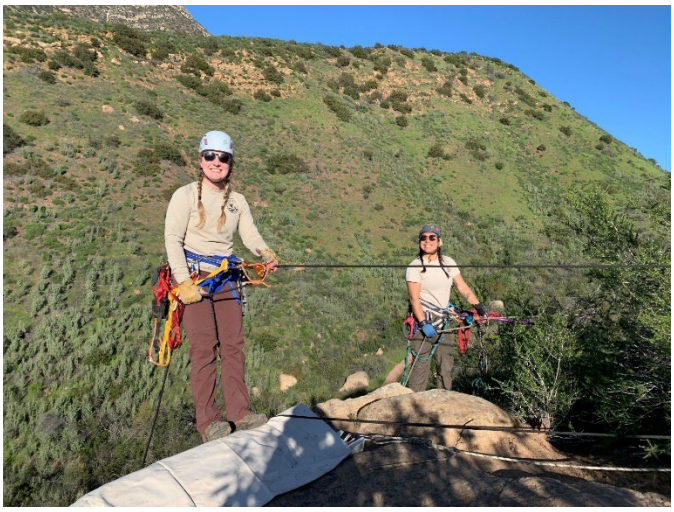


Figure 5, Two USFWS staff participate in an interagency technical ropes training with NPS and Santa Barbara Zoo. NPS/Alacia Welch

Biologists install remote video cameras in suitable nests when possible. Factors determining suitability include nest location, level of risk to access the nest, whether the nest interior can be viewed from a distant observation point, landowner permission, and site topography. Biologists follow an installation design and method developed by the USFWS Condor Program. After locating a nest site, they enter the nest for an egg fertility check and decide whether to install a video camera. They set up a solar panel and battery within a hundred meters of the nest and connect to the video camera in the nest. A microwave antenna is also powered by the solar system and transmits the video signal to a receiving antenna with a direct connection to a computer running video recording software. This software allows live viewing as well as the ability to review recordings up to five days old. Nest video cameras greatly increase the number of hours of nest observations, enhance the quality of observations, and reduce the amount of time field staff spend hiking to remote nests. The cameras allow biologists to observe nestling health, nestling-parent interactions and other important events that would otherwise go unrecorded.

Baiting

Biologists primarily use calf carcasses acquired from organic dairies as food for captive and free-flying condors. Carcasses are placed approximately twice per week at one or two established bait stations in the park. During trapping seasons, carcasses are placed exclusively in the trap with the goal of increasing trap success. Other carcass types may also be placed after they are radiographed to ensure they contain no foreign or metallic objects, such as spent ammunition. Bait stations are in an area of the park closed to the public with one at the captive pen and a second on a hilltop. Pools for drinking and bathing are also at each bait location (Figure 6). Safety protocols for baiting traps and stations require proper PPE, four-wheel drive training, and placement of carcasses by at least two people. Carcasses are placed at night to minimize the association with humans as food suppliers.

Figure 6, Condor drinks from pool. NPS/Erin Lehnert

Remote Monitoring

Remote video cameras positioned at the captive pen and bait site record during daylight hours, allow biologists to perform physical checks on individual birds, observe condor interactions, and document feeding patterns. Memory cards from motion-triggered trail cameras are replaced weekly and

photographs are reviewed for presence of predators and to identify condors that visit the sites. Photographs and video recordings allow biologists to track the general condition of condors and document those without functioning transmitters.

Non-proffered Food

Non-proffered food is any carcass not placed for condors at pre-established bait sites by PINN or VWS staff. When condors are observed feeding on non-proffered food, biologists identify the carcass species if possible. Observing condors feeding on private land from public roads is often limited and biologists are rarely able to identify carcass species. Landowners are contacted about a carcass on their property only when there is a specific concern.

Captive Condors

Condors are held at PINN's captive pen as needed for flock management. Reasons for captivity include acclimating captive-reared condors to the area prior to initial release, holding captured condors until they can be handled to replace transmitters and undergo health checks, observing condors with health concerns, or holding individuals who act as mentors to new birds. Biologists closely monitor condor health and interactions while in captivity (Figure 7). Power poles outfitted with wire laid along the cross beams to deliver mild electric shocks are located inside and outside the pen to discourage condors from landing on power poles when in the wild.

Figure 7, PINN captive pen with six condors perched inside and one free-flying condor perched on top. NPS/Gavin Emmons

Missing Birds

When a free-flying condor goes undetected for over a week using all standard monitoring methods, including radio signals, camera/video image review, and GPS tag data, monitoring efforts increase by extending the radio-tracking search area and using aerial telemetry flights through a partner organization or contractor. Following USFWS guidance, missing birds not detected for 12 months are considered dead and are removed from the population total. Other factors, such as breeding status or suggestive information like detection of a mortality signal, may allow certain missing birds to be classified as dead prior to 12 months. Missing nestlings are usually determined by parental behavior and declared dead two to three months after they disappear.

Management

The main threat to condors in central California is lead exposure from spent ammunition fragments in scavenged carcasses. Other risk factors include, but are not limited to, electrocution from perching on power poles or flying into power lines, drowning in open water tanks, microtrash consumption, disease, and shootings. PINN manages condors to reduce the impacts of these risks.

Lead Sampling

From 2008-2012, both PINN and VWS attempted to capture all birds twice per year for a research study evaluating condor lead levels. When the study concluded, trapping objectives changed to catching all condors at least once per year. In 2020, trapping efforts were reduced due to COVID-19 protocols and the loss of the VWS pen in Big Sur from the Dolan Fire. Beginning in 2022, PINN returned to the goal of trapping all PINN-managed condors annually and VWS condors as directed by their staff. In 2023, construction of the VWS Big Sur pen was completed and VWS staff began trapping condors at this location again.

Trapping condors allows for tag and transmitter maintenance as well as managing risk factors that affect condor survival. Biologists take blood samples to determine blood lead levels each time a bird is captured from the wild. For PINN-managed condors, blood lead testers suitable for field use, are used to obtain immediate results that determine whether a condor requires treatment for high blood lead levels. The threshold used to initiate chelation treatment is a blood lead value of 35 micrograms per deciliter (µg/dL) or greater on a LeadCare II Analyzer (Magellan Diagnostics). Condors with elevated blood lead levels are radiographed in the PINN Condor Care Unit (CCU), at zoos, or clinics to help inform treatment needs. Birds with possible metallic densities in their gastrointestinal systems, or those with blood lead levels >65 µg/dL, are transported to the Oakland Zoo or LA Zoo for treatment. Condors with clear radiographs and blood lead levels between 35-65 µg/dL are treated at PINN when there is sufficient staff capacity to provide daily care, otherwise they are transferred to zoos for treatment. In addition, condors with clear radiographs and blood lead levels between 25 and 35 µg/dL may be monitored for two weeks in the PINN captive pen. Occasionally these protocols are suspended when unusual circumstances require it.

For VWS-managed condors, treatment of lead exposure is initiated if clinical signs are observed in the bird prior to or during handling. Blood samples are not analyzed in the field, unless requested by VWS staff, but are shipped to a lab for analysis. The National Park Service (NPS) Institutional Animal Care and Use Committee (IACUC) permit for PINN allows VWS treatment protocols to be applied when VWS-managed condors are trapped at PINN.

Highly Pathogenic Avian Influenza Sampling

With the new threat of HPAI affecting condors, biologists collect swabs from the oral cavity and cloaca of each condor when it is initially handled. These swabs are sent to a lab for analysis within seven days of

collection and results are typically received within one to five days. If a condor is held for medical reasons, such as lead chelation treatment, a negative swab result must be received before the condor can be transferred to a zoo for additional care. Therefore, the lead treatment protocol for condors with blood lead levels >65 µg/dL have been modified to include waiting for HPAI swab results. These condors are radiographed and treated at PINN until the swab result is received.

In addition to swabs, biologists collect serum from every condor for HPAI antibody analysis. These samples are stored frozen until enough have been collected for efficient testing.

Veterinary care

Pinnacles biologists are permitted to conduct basic first aid for superficial wounds discovered during handling. Any treatment requiring veterinary care is conducted by or under the guidance of a licensed veterinarian in the field, at a veterinary clinic, or at a zoo.

Vaccinations

Captured condors receive intramuscular West Nile Virus (WNV) vaccinations and boosters on a schedule provided by veterinarians. In 2023, the schedule remained the same as recent years, with a goal of vaccinating 100% of the flock on an annual basis and giving nestlings a minimum of two shots spaced at least 30 days apart while still in the nest. This schedule was followed for all captured birds and for nestlings where nest entries were possible.

Beginning in 2023, the USFWS and USDA approved the use of Zoetis, 1057.R1 Avian Influenza Vaccine, HPAI H5N1 subtype killed virus for condors. This vaccine is strictly regulated and can only be administered by a state registered veterinarian. It is two doses that are given at least 21 days apart. All pre-release juvenile condors for U.S. release sites are given both doses of the vaccine prior to release into the wild. Organizations with site plans approved to administer the vaccine are also allowed to vaccinate any wild condors that come into their facilities for care. In 2023, PINN submitted a vaccine site plan to the USFWS, USDA, and State of California, and is expecting to receive approval in early 2024.

Hazing

Hazing may be needed when condors endanger themselves by approaching humans or landing on human infrastructure. Hazing methods vary depending on location and may include clapping and charging, clapping wood blocks together, spraying water, using air horns, and throwing pebbles near a condor.

Personnel

Implementing a long-term endangered species recovery program requires consistent staffing levels with highly trained, experienced biologists. The current program structure includes a program manager, two field crew leaders, an intern fellow, and two interns, all working full-time and year-round. An additional wildlife biologist works with the program full-time for six months per year and PINN's invasive animal biologist works throughout the year with half their time dedicated to non-lead outreach.

Volunteers provide vital program support and receive extensive training prior to assisting in the field. Volunteers are asked to make a year-long commitment to the program for a minimum of two days per month. Volunteers assist in radio tracking, field observations, and a wide variety of logistical tasks that support species management.

Collaborative Research

In 2023, PINN continued to work closely with researchers at Montana State University (MSU) and the University of California at Santa Cruz (UCSC) on multiple studies, including a population viability analysis, measuring condor responses to environmental risk factors, and analyzing outreach activities regarding the use of non-lead ammunition and impacts on condor populations. PINN biologists also collected fecal samples for an analysis of the condor gastrointestinal microbiome conducted by the University of California at Davis (UCD) and serum samples for a blood copper levels baseline study coordinated by the Condor Recovery Program veterinarian, Jeff Zuba. Additionally, a collaborative study including NPS, USFWS, USDA, VWS, the Yurok Tribe, and The Peregrine Fund got underway in 2023 to assess avian influenza presence in all wild condor U.S. subpopulations.

Outreach

The PINN Condor Program defines outreach as any activity that provides an opportunity for greater understanding of a particular resource or issue. Activities include, but are not limited to promoting awareness, presenting information, and building partnerships through education. Outreach to surrounding communities and those affected by conservation actions on public lands provide an opportunity for greater trust and cooperation between PINN and local residents with the goal of stewarding natural resources together.

Outreach fosters communication and understanding of the needs and concerns beyond the park boundary and creates opportunities to realize aspects of natural resource conservation that have not been previously considered. These opportunities assist immediate and long-term efforts, whether they are related to condor recovery, the use of non-lead ammunition, or any community conservation effort. As lead exposure in wild condors continues to be the primary obstacle to recovery, we prioritize outreach with broader, multi-regional NPS staff, other land-management agencies, local landowners, ranchers, hunters, and the general public about the impacts of spent lead ammunition to scavenging wildlife (Figure 8). Pinnacles dedicates half the time of one biologist to conduct outreach and work closely with the Institute for Wildlife Studies (IWS), VWS, The Peregrine Fund, Oregon Zoo, and other partners to collaborate on outreach efforts. Additionally, during routine fieldwork, Condor Program employees, interns, and volunteers speak with park visitors. Outreach is conducted in the local community, statewide, and at larger scales in coordination with other partners and NPS

Figure 8, An example of a non-lead outreach booth. NPS/Daniel Ryan

Regional and National staff to address the complexity of this issue, from local perceptions to nationwide non-lead ammunition availability.

Hunting and ranching operations are essential to condor recovery. These operations depend on clean water and healthy habitats to sustain livestock and wildlife species. Condors benefit from these water resources and areas to forage. Carcasses or remains left on the land are an important food source for condors. The success of condor recovery relies on developing trust-based relationships with hunting and ranching communities and fostering ownership of animal health.

Pinnacles' outreach message is focused on how condors benefit from hunting and ranching operations when non-lead ammunition is used. Staff discuss available alternatives to lead ammunition, as well as how to achieve the best performance from non-lead ammunition. Additionally, PINN communicates with other land management agencies the benefits of reducing wildlife lead exposure from external and internal actions and how to implement new practices. With park visitors, staff highlight the need for continued hunting and ranching and how those traditions play an important role in wildlife conservation.

RESULTS

Population Monitoring

At the beginning of 2023, PINN managed 29 of the 94 condors in central California, approximately 30% of the flock. Over the year, there were four deaths (including one nestling), five captive-reared birds were released, and two condors fledged. The total number of PINN-managed condors by the end of 2023 was 33, marking the second consecutive year with a net gain.

On December 31, 2023, 100 condors occupied the central California region (Figure 9). Combined with condors managed by VWS, there were ten nesting attempts, with eight of those including at least one PINN condor. Four nests fledged young with two managed by PINN and two by VWS. The ratio of adult males to females was skewed toward males, with 66% of the central California population male and 33% female. Adults are defined as those hatched in 2018 or earlier. This skewed sex ratio continues to be a concern because it impacts annual productivity and could be a long-term problem.

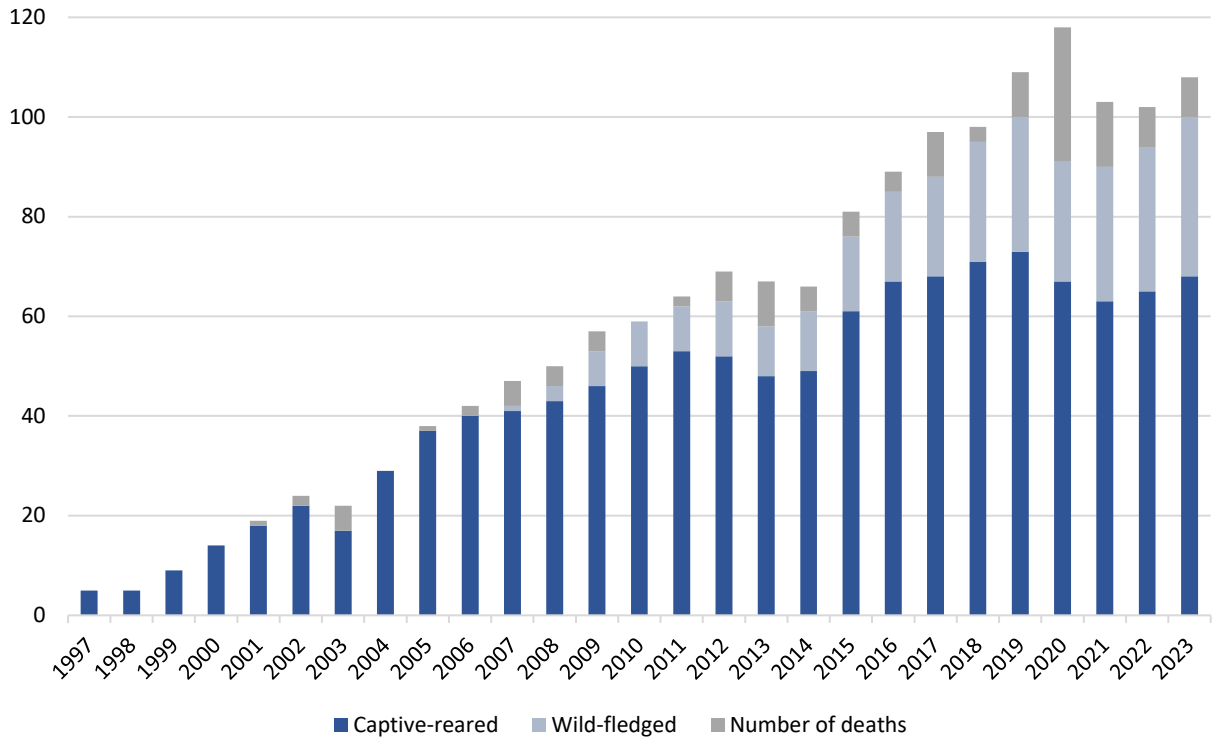


Figure 9, Summary of wild-fledged condors, captive-reared releases, and annual number of deaths in central California from 1997-2023. Chart presents total number of condors in the wild (both wild-fledged and captive-reared) currently managed by PINN and VWS in the central California area, in addition to the number of condor deaths each year. Condor nestling deaths are not included. VWS data provided by J. Burnett.

Survival Monitoring

Throughout the year, PINN monitored radio- and GPS-tagged condors almost daily. Condors without functioning transmitters were observed opportunistically. This year, there were 3,466 visual observations of wild condors by PINN biologists in the field and 4,882 sightings from remote video and trail cameras.

Pinnacles aims to have at least 75% of the PINN-managed flock tagged with GPS-transmitters. In 2023, that goal was reached; 30 different PINN condors, or 83% of the flock, wore GPS tags. Hundreds of thousands of locations were downloaded from the GPS tags and often directed daily crew tracking activities. Condors released by both VWS and PINN use the landscape in all directions surrounding the park as indicated by the red-dashed line in Figure 10. This outline represents the core range of all central California condors, including those managed by VWS, with GPS tags in 2023. Because condors are social and regularly move across the landscape together, monitoring some individuals with GPS tags adds great efficiency to locating all released condors, including those without functioning transmitters.

Noted Movements

In 2023, multiple PINN-managed condors spent extended periods of time in the hills around Pacheco Pass and Henry W Coe State Park which is indicated by the highest density purple area at the northern end of the range in Figure 10. Six condors forayed north to the Mt. Diablo area in September, and all flew over the Altamont wind farm (Figure 11). Additionally, Condor 1027, covered the entire historic range for condors, starting with flying south to join the USFWS-managed flock in May and then returning to central

California and flying as far north as the hills east of Fremont (Figure 12). Condor 1027 remained in southern California at the end of the year.

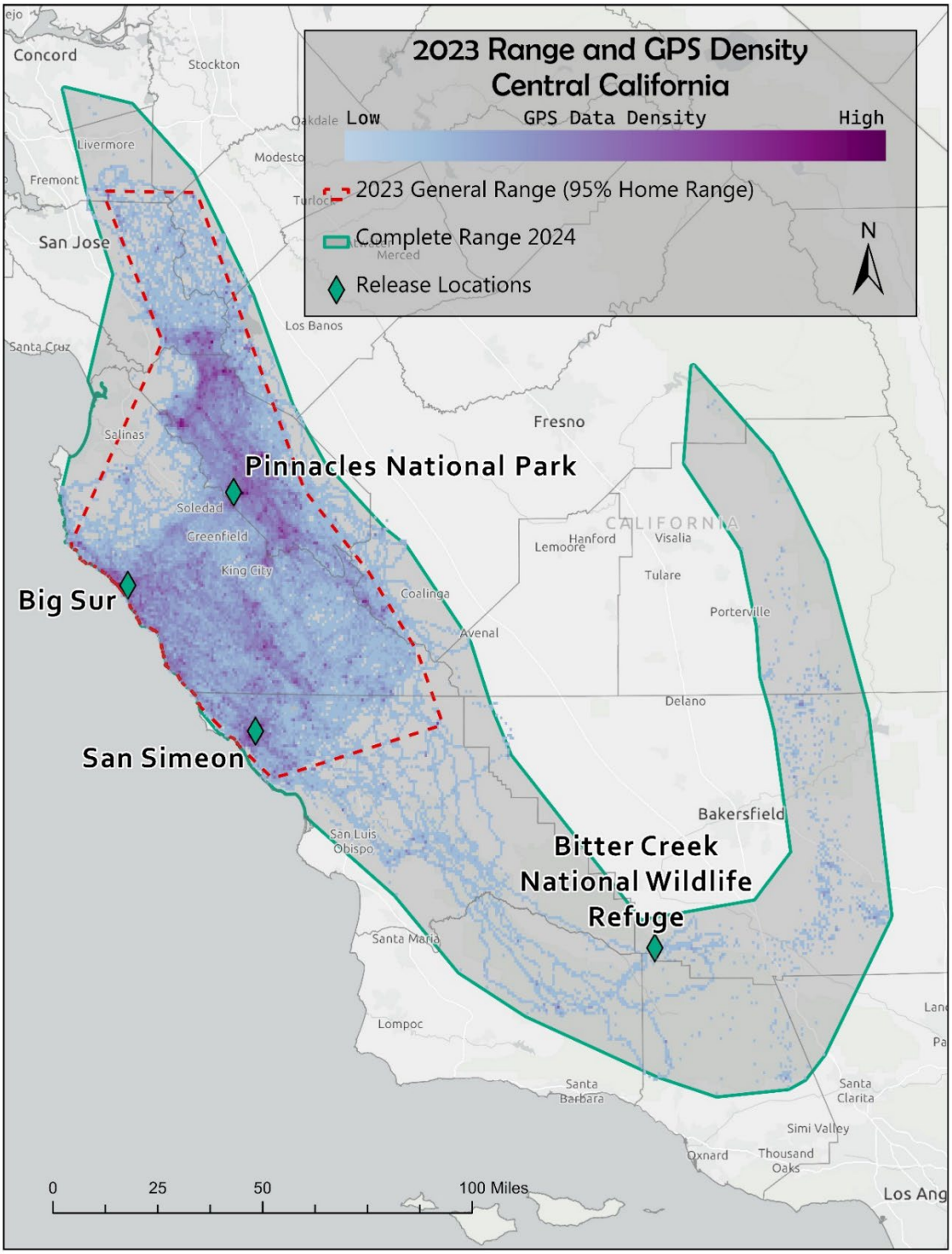


Figure 10, Central California condor range and use density, 2023. Map courtesy of Evan McWreath, VWS.

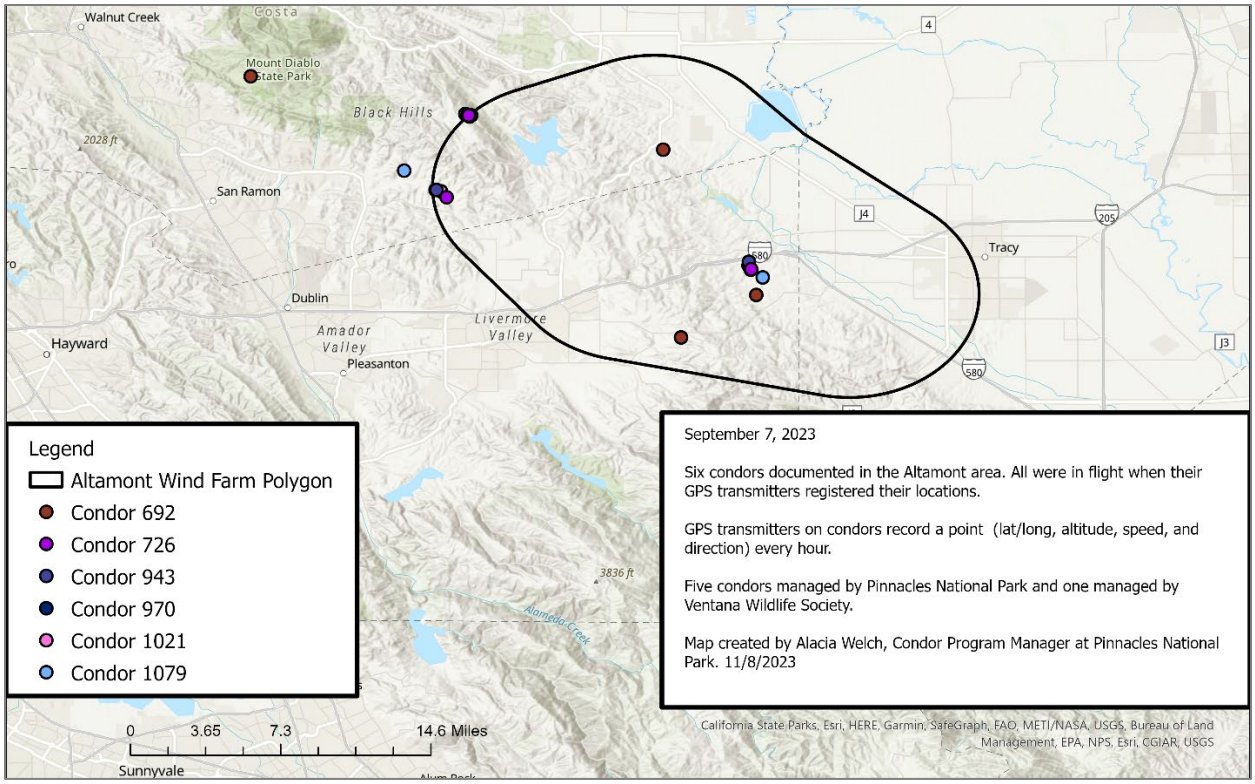


Figure 11, Map of condors recorded in Mount Diablo State Park and Altamont Wind Farm, September 2023. NPS/Alacia Welch

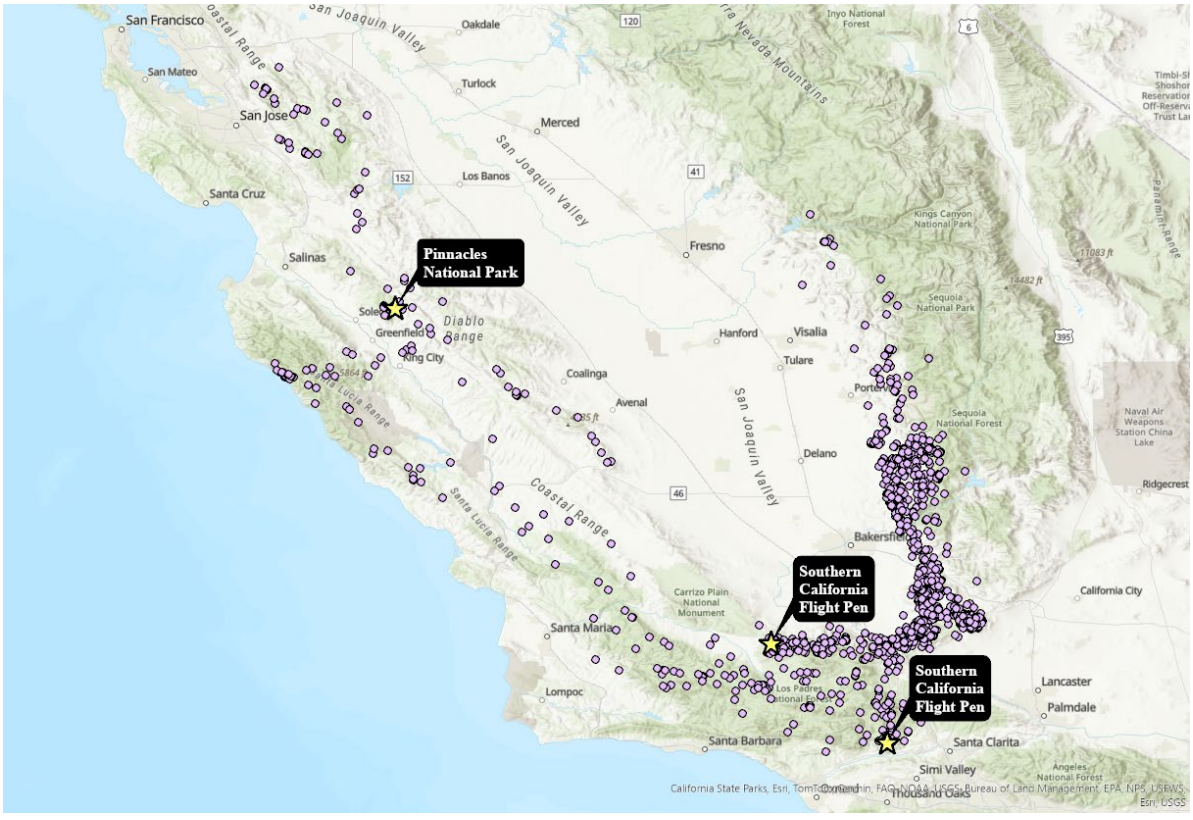


Figure 12, Condor 1027 locations from GPS tag (lavender circles), May 3 - December 31, 2023. NPS/Kaitlin Lopez

Mortality

In 2023, four PINN-managed condors died, three free-flying condors and one nestling. These deaths bring the total loss of PINN-managed condors to 60 birds (Appendix A). All four deaths occurred in the wild; three were free-flying condors whose remains were retrieved and submitted to the National Fish and Wildlife Forensic Lab for necropsies and the fourth was a chick that died in the nest before fledging and was not recovered. Lead toxicosis was the cause of death for two of the condors and the third died from trauma related to entrapment in a landslide (Figure 13).

Figure 13, Condor trapped in a mudslide. NPS/Alacia Welch

Trapping

Pinnacles had a reduced level of trapping effort when compared to the previous year, but the number of captured condors was similar (Table 1). While the VWS pen in Big Sur was under construction until August 2023, PINN was effectively the only site operating in central California to capture condors in the region. Pinnacles staff spent 76 days trapping and captured 34 individual condors, not including those handled in nests or netted in the wild (Table 1). Four individuals were caught twice in 2023. The condor pen was inaccessible for five days in mid-January due to creek flooding that caused the road to be impassable. Concerns about highly pathogenic avian influenza (HPAI) halted overall trapping effort in early May but trapping recommenced in September.

Year	Total handling days [a]	Total captures [b]	Total individuals captured [c]	Person Days [d]
2019	27	96	50	171
2020	11	22	20	47
2021	27	58	45	135
2022	22	37	33	162
2023	15	38	34	76

Table 1, Five-year review of trapping effort and captures of PINN and VWS-managed condors at PINN captive pen.

[a] Days that biologists initially handled any condors trapped at PINN. These include condors caught for health checks, transmitter replacements, or as non-targets. Nestling handlings at nests are not included.

[b] Number of condors trapped including multiple captures of the same individual in given year.

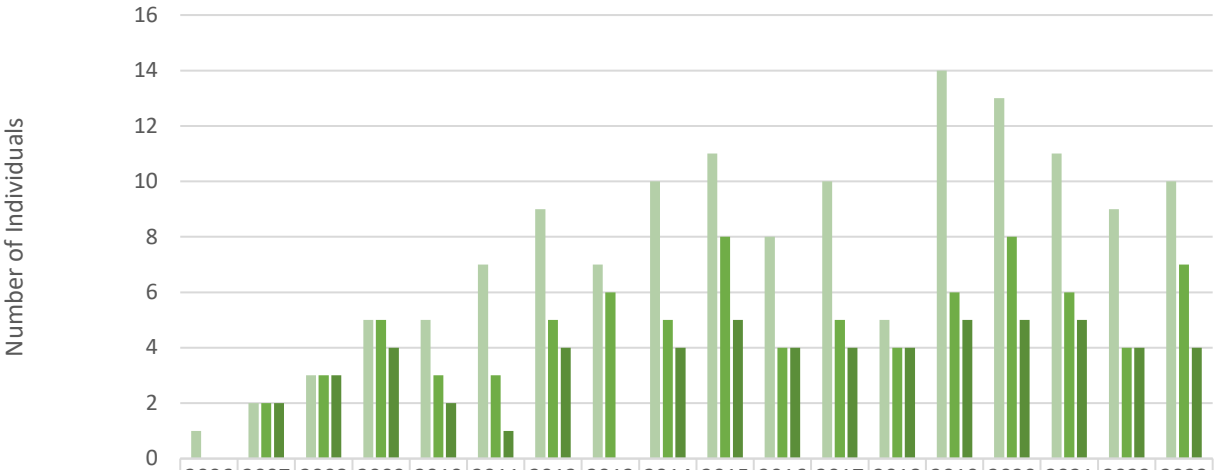
[c] Number of individual condors trapped during given year at PINN.

[d] Number of days a staff member could have trapped a condor if a target condor went into the trap.

Nest Monitoring and Reproduction

In 2023, there were ten nesting attempts in central California and four fledged young (Figure 14). Pinnacles managed six of the nests and VWS managed four. Of the PINN-managed nests, four were in the park and two on private property in San Benito County. The nests on private lands were inferred by movement patterns of both parents as determined by their GPS tags. Of the six PINN-managed nesting attempts, two pairs successfully fledged young and two pairs each attempted nesting twice, but both

attempts failed. One pair successfully hatched a chick, but it died after six weeks and was not collected. Their second attempt failed before hatch for unknown reasons. The other pair's first nest failed when only eggshell fragments were seen in the nest and the second nest failed when PINN biologists entered the nest and determined the egg was not viable.



	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Wild-laid Eggs	1	2	3	5	5	7	9	7	10	11	8	10	5	14	13	11	9	10
Nestlings	0	2	3	5	3	3	5	6	5	8	4	5	4	6	8	6	4	7
Fledglings	0	2	3	4	2	1	4	0	4	5	4	4	4	5	5	5	4	4

Figure 14, All known central California condor nests, 2006 - 2023. VWS data courtesy of J. Burnett

Pinnacles Condor Nesting Details

Pinnacles actively manages condor nests deemed accessible to gain an understanding of the risks that may be present during nesting and to mitigate those risks. Management activities may include checking egg fertility, performing nestling health checks, providing care or treatment to nestlings, removing microtrash within nest cavities, and installing nest cameras. Nesting results should be interpreted with these management activities in mind. In addition, each year the number of breeding-age condors varies in the central California flock, impacting the number of nesting attempts.

Figure 15, PINN biologist carefully holds nestling Condor 1215 with a hood over the head. NPS/Gavin Emmons

In 2023, biologists conducted nest entries at three nests within the PINN boundary. One nest was entered to check egg fertility. The egg was found to be infertile and was removed to encourage the pair to recycle, but they did not. The second nest was entered once to perform a 45-day health check on the nestling. The team planned to perform a 120-day

entry, but decided it was unsafe given the mobility of the nestling and the terrain around the nest. Biologists entered the third nest in the park three times; once to check egg fertility and install a nest camera, once to check nestling health at 45-days old and administer a WNV vaccine, and once to perform a 120-day health check on the nestling, provide a WNV booster, and place a tag and transmitter (Figure 15). The video camera in this nest was used to monitor nestling behavior, parental interactions, and overall development (Figure 16). In June, PINN biologists noticed that the nestling had a swollen left cheek, and they were able to closely monitor this issue without intervention.

Figure 16, Condor sire 589 and hatchling 1215 with partial eggshell visible in nest observed on nest video camera. NPS Photo

Normal nesting patterns for condors are thought to be as follows: the parents have one egg that hatches after two months of incubation, and they tend to the nestling until it fledges six months later. The parents continue to feed and help integrate their fledgling into the greater flock over the next six months, thus forgoing nesting for a year. At PINN, there are two pairs that have successfully fledged young and started nesting the following year. For condors 589 and 569, 2023 was the third consecutive year that they successfully nested and fledged an offspring. Condors 340 and 236 have nested at PINN every year for the past four years and had one year with a nest failure, 2022.

Microtrash

During nest entries, staff search for small trash, or "microtrash," brought to nests by the parent condors. Since 2009, 69 nest entries included a search for microtrash and biologists found bottle caps, a shotgun

shell, a penny, and other items made of glass, metal, plastic, rubber, and cloth. These items weighed 0.07 to 26.9 grams.

In 2023, PINN staff conducted six nest entries at four nests. Three of the nests were within PINN and the fourth was a VWS-managed nest in Los Padres National Forest (LPNF). The nests in PINN contained one ~3cm piece of brown glass, 5-6 small plastic fragments, several pieces of black rubber, one ~5cm red shotgun shell, one orange road reflector fragment, four large shards of glass, one small piece of green plastic, one orange bottle cap ring, and one large piece of dark plastic; all of which were removed during the nest entries. The LPNF nest contained one penny and two pieces of glass.

Baiting

In 2023, biologists placed 141 calves procured from dairies near Modesto and Petaluma, CA to bait the trap at the captive pen, feed captive condors, and attract condors to a video-monitored bait site. Other bait items from other sources placed for condors included eight sheep and a lamb procured from a ranch in Paicines, CA, and 11 kid goats donated from the Northern California Condor Restoration Program.

Remote Monitoring

Staff reviewed tens of thousands of remote motion-triggered photos and thousands of hours of video recordings. Both trail and video cameras were located at the captive pen and bait site to document condors present and any predators that may be attracted to the bait. Biologists installed a video camera in a nest to view the nestling until it fledged. One noteworthy observation in 2023 was a gray fox that climbed up the trap at the condor pen in December; there was no harm done to condors in or near the pen (Figure 17). In total, remote cameras documented 4,882 sightings of individual condors.

Figure 17, Gray fox captured on a trail camera climbing to the top of the drop-in trap at the condor pen. NPS Photo

Non-proffered Food

In 2023, biologists and members of the public recorded observations of four non-proffered feeding events that resulted in observations of 16 individual condors feeding on carcasses other than those provided at the PINN or VWS bait sites. Most feeding events in the wild go unrecorded due to limited access to private land and the dispersed nature of animals across the landscape. They rarely occur in PINN, making one of the non-proffered feeding events from this year of interest, when a presumed mountain lion deer kill was observed in the High Peaks area and 11 condors fed on the deer.

Captive-reared Releases

In November and December 2023, five PINN-managed juveniles were released from the VWS San Simeon pen during two live-streaming release events. The VWS team retrofitted this pen to be less susceptible to HPAI contamination from wild birds and both PINN and VWS agreed that all 2023 juveniles for central California should be released from this pen. The PINN-managed juveniles hatched between March and April 2022 and arrived in San Simeon in October 2023. Upon release, they successfully navigated the transition out of captivity and survived their first months in the wild.

Missing Birds

There were no missing free-flying PINN birds declared dead in 2023, however one nestling disappeared from an inaccessible nest and was declared dead based on the behavior of the parents.

Management

Lead Sampling

Blood lead sampling continued to be a priority for the entire central California condor population. In 2023, PINN and VWS biologists collected 51 blood samples from 46 condors, about 43% of the population, and, of those, 22 were PINN-managed (Figure 18). Figure 19 summarizes the initial blood lead values for all captured central California condors, including nestlings, those caught in traps, and those netted in the wild since 2013. The percentage of condors over 35 µg/dL continues to fluctuate year to year with the number in 2023 lower than the previous three years (Figure 19).

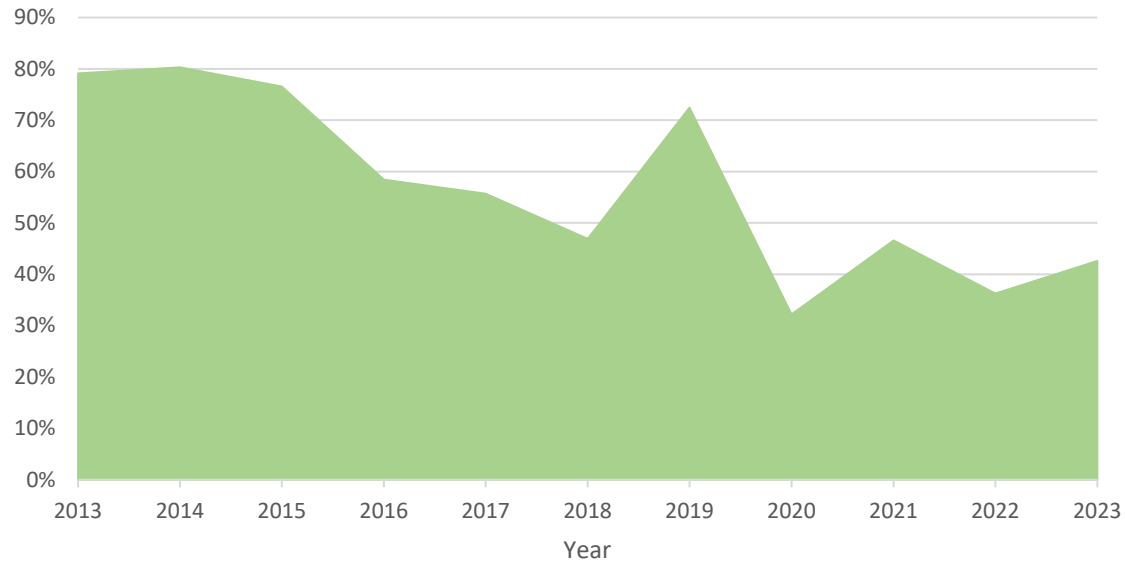


Figure 18, Percent of central California flock of condors captured, 2013-2023. VWS data provided by J. Burnett.

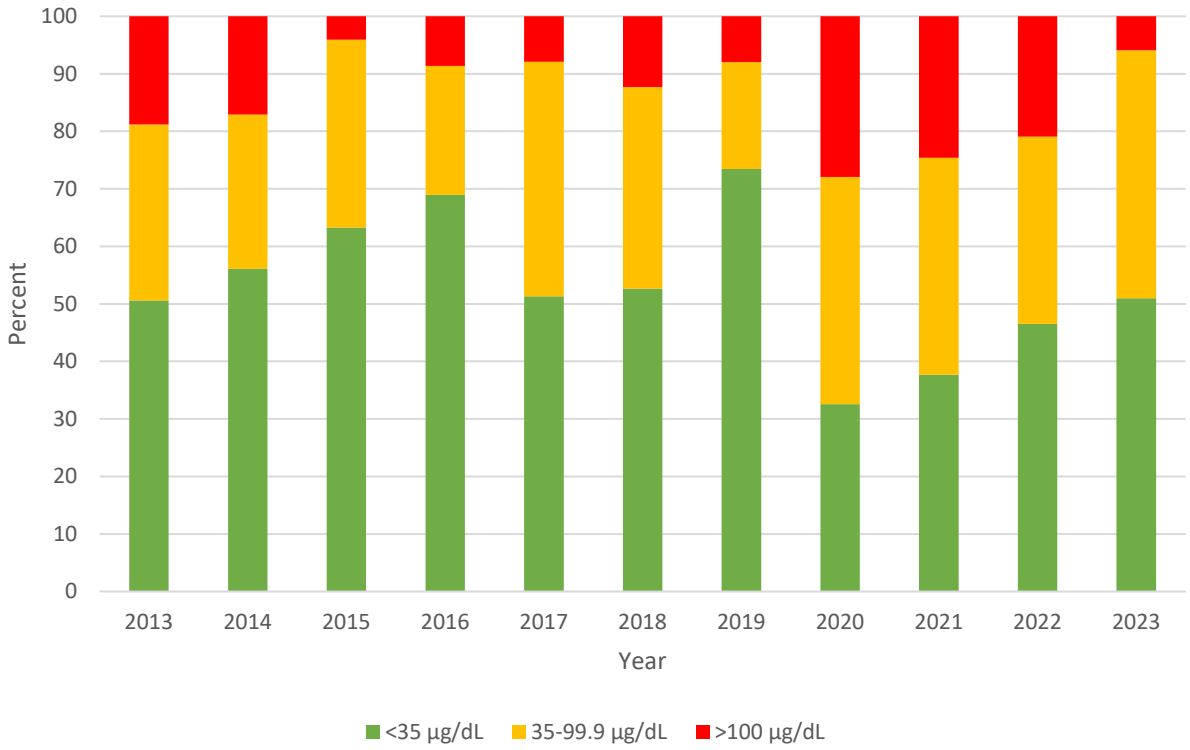


Figure 19, Central California condor initial blood lead levels in µg/dL by percent of total samples collected, 2013 – 2023. VWS data provided by J. Burnett.

Highly Pathogenic Avian Influenza

Beginning in February 2023, PINN biologists collected 46 oropharyngeal/cloacal swabs for avian influenza testing from all condors that were captured and handled at PINN. Twenty-two PINN-managed condors were tested, and all were negative. When possible, serum was also collected and submitted for a multi-year avian influenza antibody testing study. Serum samples were collected from 18 PINN-managed condors and results are pending.

Veterinary Care

Radiographs and Chelation Treatments

In 2023, five PINN-managed condors were radiographed due to elevated blood lead levels or other medical concerns (Appendix B). Additionally, one VWS-managed condor was radiographed at PINN due to medical concerns and re-released into the wild following a clear radiograph. Two PINN condors were radiographed at PINN, received chelation treatment on site until their blood lead levels decreased to 35 µg/dL or less, and were re-released into the wild. One PINN condor exhibiting signs of illness, but with a blood lead level less than the treatment threshold, was radiographed and held for observation without chelation treatment following a clear radiograph. Two PINN condors with elevated blood levels were radiographed and given chelation treatment at PINN before they were transferred to the LA Zoo for further radiographs and chelation treatments. For one of these condors, radiographs revealed six small

shotgun pellets in the feathers and embedded in the skin on the face (Figure 20). No PINN-managed condors were transferred to the Oakland Zoo for care this year.

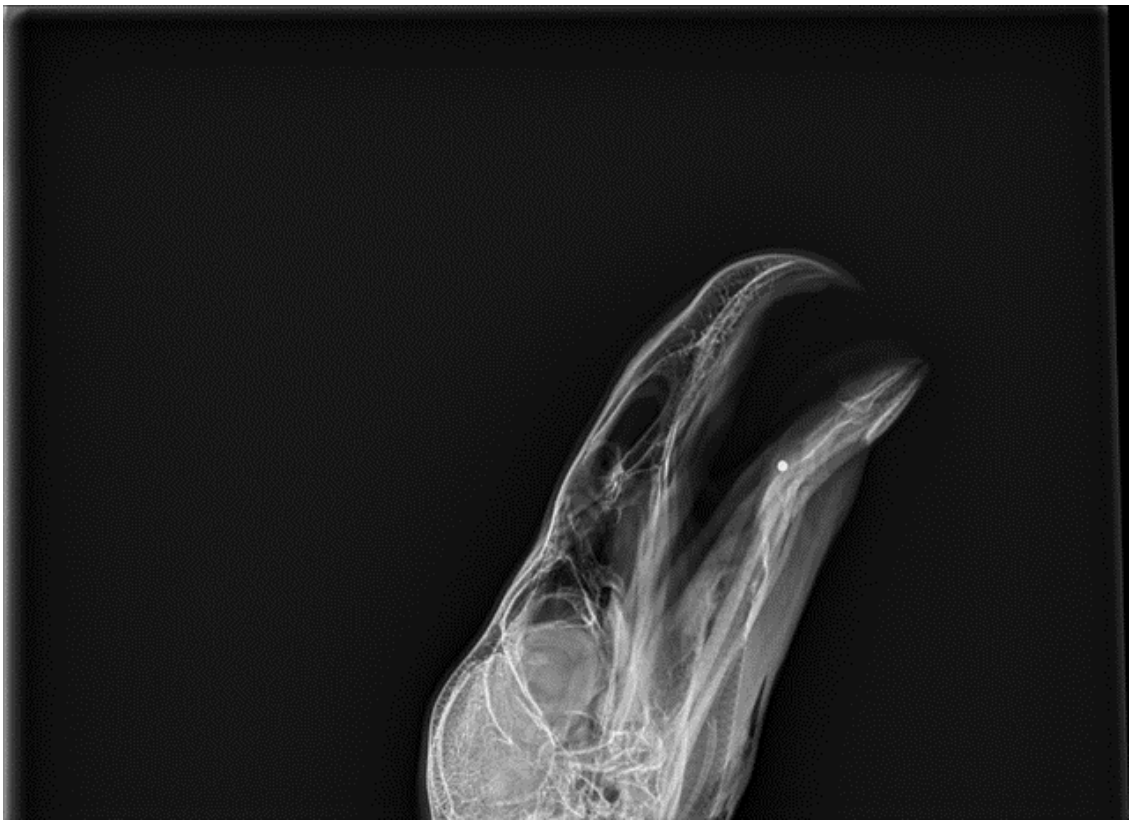


Figure 20, Radiograph of condor with shotgun pellet embedded in lower jaw. Image courtesy of Los Angeles Zoo

Surgeries

In 2023, two PINN-managed condors were put under anesthesia at the LA Zoo for surgery, one for patagial hole repair and the other to remove three shotgun pellets: one embedded under the skin in the lower jaw area, another in a feather on the right wing, and a third one in a tail feather.

Vaccinations

In 2023, 21 PINN condors received WNV vaccinations. Seven PINN condors received Zoetis, 1057.R1 Avian Influenza Vaccine, HPAI H5N1 subtype killed virus vaccinations. All five pre-release condors received their first doses prior to transfer to the San Simeon holding pen. After 21 days, they were given a second dose and later released. Additionally, two PINN condors that were at the LA Zoo for chelation treatment were given one dose of the vaccine before they were transferred back to central California and released into the wild.

Hazing

In 2023, 3 condors were hazed by staff for being in locations deemed unsafe or dangerous.

Personnel

In 2023, the Condor Program was at full staff until August when a crew leader departed. There is currently one program manager, one crew leader, one biologist for half the year, and a non-lead outreach specialist

also for half of the year. The program partnered with Conservation Legacy and American Conservation Experience, youth internship organizations, to provide four 6-month internships and one year-long fellow position. These youth contributed 4,934 hours. Additionally, 14 people volunteered 1,923 hours.

Collaborative Research

Working collaboratively with USFWS, VWS, universities, and other researchers is a high priority for PINN and helps accomplish recovery goals. Multiple studies are underway to better understand threats to condors and how management can reduce their impacts.

Population Management Analysis for Condor Program Efficiencies

Montana State University (MSU) and University of California, Santa Cruz (UCSC) researchers developed a survival analysis model with data and input from PINN, USFWS, and VWS for all condors in California. Initial results with data through 2013 were published in 2016 by Bakker, et al (Appendix C). In 2021, data through August 2018 was incorporated. Subsequent analysis suggests survival rates are lower than the previous analysis ending in 2013. Survival and reproductive rates were incorporated into an updated population model to assess the influence of management on population health. Results from this research will inform management decisions for release sites, captive rearing facilities and overall recovery strategies. One scientific paper from this research was published in 2023 and another is expected in early 2024 (Appendix C).

Protect Condors Using New, Cost-Effective Methods

Pinnacles is partnering with UCSC to analyze lead concentrations and isotopic compositions in condor tissues and fragments to yield data that more accurately predict lead exposure risk as well as inform management actions. Pinnacles and VWS staff collect blood and feather samples that UCSC researchers analyze. Lead concentrations and isotopic compositions in sequential feather segments from individual birds provide data on the degree, frequency, and severity of lead exposures in condors. Recent analyses have used feathers to demonstrate lead as a contributing cause of death in multiple condor mortalities and that condors continue to be lead poisoned after a statewide ban on hunting with lead-based ammunition. A case study related to this research was published in 2023 (Appendix C).

California Condor Bi-national Recovery and Reintroduction Program, United States and Mexico

Pinnacles contributed data to a demographic model developed by UCSC and MSU. Partners from each condor sub-population (California, Baja, and Arizona/Utah) submitted data through September 2021. A draft demographic model has been constructed to test the influence of management on condor population growth.

Chelation Treatment Impacts on Short-term Survival

In 2019, PINN and VWS, in collaboration with MSU and UCSC, began a three-year study comparing survival of condors with and without treatment to asymptomatic lead exposure. All PINN-managed condors are radiographed and chelated if field blood lead values are 35 µg/dL or greater. All VWS-managed condors are radiographed and chelated when they display symptoms of lead exposure. Blood samples are taken for all PINN and VWS condors and submitted for laboratory analysis. These data will be tied to the treated and not-treated groups to better understand the effectiveness of chelation on survival rates between the two groups. Due to trapping and treatment protocol changes because of the pandemic starting in 2020 as well as the H5N1 HPAI outbreak in 2022, this research study was extended. Preliminary results were shared with all condor recovery partners in 2023 and further analysis is anticipated in 2024.

Increase California Condor Survival by Decreasing Lead Poisoning

A project to incorporate quantifiable non-lead outreach effort into condor population models began in 2022. This project will be conducted in three phases over a five-year period. Phase 1 has been initiated and UCSC is working directly with non-lead outreach specialists to, i) identify suitable metrics to include in survival analyses, ii) aid with the formatting of outreach data, and iii) determine additional data needs for use in lead risk models.

Assess Copper Exposure

While lead exposure in condors is well documented, little information is known about copper exposure. A threshold for copper toxicity has never been established for condors, so veterinarians within the broader condor recovery program began a pilot study in 2022 to address this question. Biologically, copper behaves very differently from lead and is an essential element for cellular processes. Pinnacles collected serum samples from captured condors to contribute to this study.

Disease Surveillance of Avian Influenza in Condors

In response to highly pathogenic H5N1 strain of avian influenza (HPAI) arriving in North America and reducing the Southwest condor population by almost 20%, veterinarians with the NPS Biological Resource Division, USFWS, and USDA are working with all condor release sites in the U.S. to collect swab and serum samples to detect presence/absence of avian influenza. Research questions and study design are still in development with partners, but sample collection is expected to continue for another four years.

Condor Microbiome Composition

In 2022, University of California, Davis (UCD) researchers started a new line of research to identify the composition of the condor microbiome within the gastrointestinal tract. They hope to determine if rearing strategy within the captive-breeding environment influences gut microbiome, discover differences in the microbiomes of captive-bred parent-reared condors and captive-bred puppet-reared condors, and see if external factors influence microbiome composition and diversity between captive and wild adults. PINN biologists collected fecal samples from adult condors when they were trapped for routine handling needs and from pre-release juveniles when they arrived on site. This study was paused in 2023 when concerns about HPAI intensified.

Outreach

Education and Interpretation by Condor Program Staff

In 2023, Condor Program staff conducted education and interpretation in the park and in the surrounding communities. While in the field, biologists and trained volunteers answered questions and provided visitors through informal interpretation about condors. This year condor staff and volunteers spoke with 2,694 members of the public about condors while on trail, in parking lots, or tracking outside the park. They gave nine formal presentations to a variety of audiences and reached an additional 379 people.

Focused Non-lead Ammunition Outreach

Outreach about lead as an environmental contaminant is recognized as one of the most important actions that can positively impact condor recovery. Pinnacles staff employed various strategies to educate diverse groups on the impacts of lead on condors, other wildlife, and human safety, as well as the benefits of removing lead from the landscape.

This year PINN continued conducting outreach related to the use of non-lead ammunition and lead toxicosis in scavenging wildlife due to inadvertent ingestion of spent ammunition in animal remains left

in the field. One PINN biologist with half his time dedicated to non-lead outreach continued to build on efforts from past years while initiating new projects. PINN continued to collaborate with partners working in non-lead outreach around the country (Figure 21). This collaboration was important due to capacity fluctuations and limitations associated with the lingering impact of the COVID-19 pandemic. For the first time, nearly all the partners and organizations involved in non-lead outreach met at a conference in Boise, ID to review current outreach methods and build collaborative relationships to help streamline and consolidate outreach efforts across the country. Hailed as a successful first step, the conference is expected to become an annual meeting in the future.

Figure 21, PINN Nonlead Outreach Specialist prepares to demonstrate the effectiveness of a nonlead round. Photo courtesy of The Yurok Tribe, Patrick Myers

Pinnacles, with its many partners, is committed to building on its 18-year long effort to help hunters and ranchers choose non-lead ammunition options through education and growing relationships. All partners in non-lead outreach made great progress and, although much work remains, there are positive trends in acceptance and use of non-lead ammunition. Ammunition and firearm purchases continued to rise this year across the U.S., and ongoing ammunition shortages of all types made assessments of product demand and choice extremely difficult. Ammunition and loading component availability continued to be outstripped by demand. However, manufacturers made gains developing and marketing more non-lead options, with every major ammunition manufacturer offering at least one non-lead option, and some new manufacturers focusing development on non-lead loads or bullets.

In California, due to the combination of legal requirements for using non-lead ammunition, an ongoing national shortage of ammunition, and California's "Safety for All Act" requiring face to face transfers of ammunition, much of the outreach in the state focused on non-lead ammunition availability rather than bullet performance. VWS provided a critical service to central California hunters and ranchers with their free non-lead ammunition program, which for some local ranchers was their only source of ammunition again this year. While non-lead ammunition remains a premium tier ammunition type, prices for comparable lead and non-lead ammunition continued to converge, with many comparable options having the same price point (Figure 22).

Figure 22, Non-lead (GMX) and Lead (ELDX) premium hunting ammunition priced the same. NPS Photo/Daniel Ryan

The ongoing impact of the pandemic affected outreach efforts this year, with many hunting groups only just getting back on their feet and many offering only limited engagement opportunities. Some events were still held remotely but most were in-person formats, however attendance still lagged significantly behind pre-pandemic numbers. Even with these challenges and reduced event attendance, PINN and partners reached thousands of individuals in northern and central California. New techniques and partnerships with supportive ammunition distributors also anecdotally increased effectiveness during shooting demonstration events. The pandemic forced many groups and organizations to move into virtual spaces and many have opted to continue to host a presence in that space. As a result, PINN and others have improved and expanded the online outreach capabilities.

Recognizing that the NPS and other land management agencies also play a significant role in exposing wildlife to lead through culling operations, invasive species management, and dispatch of sick or injured wildlife, outreach efforts also continued to focus on agency wildlife management. Trainings across the country on non-lead ammunition and wildlife dispatch worked to align NPS units with service-wide guidance. Pinnacles continued to offer and hold non-lead ammunition training for both staff and volunteers involved in NPS culling operations across the country.

RECOMMENDATIONS

Monitoring

Maintaining staff capacity and efficient monitoring creates a safe and sustainable program, including outreach and research components that are tied to condor management and population recovery. The increase in number of condors with GPS tags over time has improved monitoring efficiency by reducing the number of missing birds that were difficult to locate and by guiding daily field monitoring efforts. Keeping at least 75% of PINN-managed condors with GPS tags remains among the highest program priorities to maintain monitoring efficiency.

Management

The primary obstacle to condor recovery continues to be lead contamination of food sources on the landscape. Condors use public and private lands across hundreds of square miles for foraging, roosting, and nesting. Addressing the lead risk at a landscape level is essential and requires targeted and effective messaging and collaboration. Additionally, a greater understanding of the efficacy of chelation treatment will aid all condor release sites to determine the conditions when it is most useful or detrimental.

Research

Each research project conducted to date has informed management decisions that affect the recovery of the species. Pinnacles' biologists continue to work closely with researchers and prioritize the collection of samples and data that support scientific research. With limited research funding, condor recovery partners should continue to work cooperatively with USFWS leadership and discuss highest priority needs, research proposals, joint funding opportunities, data sharing, and opportunities to collaborate.

Outreach

Developing strong partnerships will continue to be an important step in successful outreach efforts. Fostering inclusion and cooperation while addressing the issue of lead exposure will promote better understanding and appreciation among interest groups. Multiple organizations and agencies work together to coordinate their efforts to reach the greatest number of people each year and to provide accurate information to interested hunters, ranchers, and wildlife managers. Outreach efforts, considered paramount for condor recovery, are still limited by insufficient funding and, therefore, staff capacity.

In 2024, it is expected that the lingering impacts of the pandemic and limited ammunition availability will continue to challenge non-lead outreach. Outreach methods will continue to be adapted to this changing reality and novel approaches will have to be developed. Virtual and digital materials will continue to play a larger permanent role, and the development and publication of these materials require additional skillsets. Non-lead ammunition availability continues to be a limiting factor that requires creative solutions until supply meets demand. An increased emphasis on social science and human dimensions will help illustrate the impact of past outreach and assist in guiding future outreach method development. PINN staff will continue working with established and new partners to broaden the scope of outreach and increase accessibility to accurate information and resources. Condor release sites and all recovery partners should continue to coordinate and fund outreach.

Recovery Planning and Multi-agency Coordination

Condor field team meetings, typically held annually and coordinated by USFWS, bring together a diversity of perspectives from experts in the field, captive breeding programs, management agencies, veterinarians, and others. Facilitated research coordination in concert with, or in addition to, field team meetings have enabled partners to prioritize needs, consider joint funding proposals, and provide future direction. Developing a framework for management decisions based on the current population viability analysis will help inform changes to management at release sites and direct well-informed decisions that are based on the best available science.

APPENDIX A –CENTRAL CALIFORNIA CONDOR DEATHS, 2001-2023

Summary table of all known condor deaths, in order by death date, in central California since release programs by VWS and PINN began.

Estimated date of death is used instead of date found and reflects first day of possible death date range, if applicable. For chicks with no carcass recovery, estimated nest fail date is used. VWS data provided by Joe Burnett, Big Sur Condor Program Coordinator and Senior Biologist.

Bird ID	Sex	Estimated Date of Death	Manager	Cause Of Death	County Recovered
230	M	5/9/2001	VWS	Electrocution: Bird electrocuted on line (mid-span)	Monterey
233	F	5/17/2002	VWS	Missing (last detected 5/15/2002)	NA
212	F	11/30/2002	VWS	Electrocution: Bird electrocuted on line (mid-span)	San Luis Obispo
254	M	2/19/2003	VWS	Electrocution: Bird electrocuted on line (mid-span)	Monterey
260	M	5/20/2003	VWS	Malnutrition	Monterey
170	M	6/15/2003	VWS	Lead Toxicosis	Ventura (Died at LA Zoo)
179	M	10/15/2003	VWS	Missing (since wildfire at Hopper NWR)	NA
256	F	10/17/2003	VWS	Undetermined: Bird recovered in desiccated state	Monterey
164	M	9/30/2005	VWS	Undetermined	Ventura
376	M	7/1/2006	VWS	Electrocution: Bird electrocuted on line (mid-span)	Monterey
363	M	7/14/2006	VWS	Malnutrition	Monterey (died at Avian&Exotic Clinic)
417	F	5/12/2007	PINN	Trauma to neck, possible predator	San Benito
301	M	5/15/2007	VWS	Electrocution: Bird electrocuted on line (mid-span)	Monterey
307	F	5/16/2007	PINN	Snakebite	Monterey
356	F	10/3/2007	VWS	Undetermined	Monterey
429	F	11/1/2007	VWS	Missing (last detected after fledging)	NA
278	M	6/25/2008	VWS	Missing (since wildfire at Hopper NWR)	NA
377	F	6/26/2008	VWS	Missing (since wildfire at Hopper NWR)	NA
336	F	9/7/2008	PINN	Lead Toxicosis	Monterey (Died at LA Zoo)
475	M	12/20/2008	VWS	Trauma (possible collision)	Monterey
286	M	5/11/2009	VWS	Lead Toxicosis	Monterey (Died at LA Zoo)
503	F	7/6/2009	VWS	Trash Ingestion	Monterey
422	F	7/12/2009	PINN	Undetermined	Fresno
303	F	10/23/2009	VWS	Lead Toxicosis	San Benito
621	M	4/29/2011	VWS	Trauma, chick died in nest	Monterey
624	U	5/29/2011	VWS	Trauma, chick died in nest	Monterey
294	F	6/29/2011	VWS	Undetermined	Fresno

499	F	11/17/2011	VWS	Aspiration	San Benito
478	M	4/22/2012	PINN	Lead Toxicosis	San Benito (Died at LA Zoo)
588	M	7/27/2012	PINN	Undetermined	San Benito
298	F	10/23/2012	VWS	Lead Toxicosis	Monterey
644	M	11/10/2012	VWS	Exposure: hypothermia	Monterey
318	M	11/30/2012	VWS	Lead Toxicosis	San Benito (Died at LA Zoo)
598	F	12/8/2012	PINN	Lead Toxicosis	San Benito (Died at LA Zoo)
312	F	4/10/2013	PINN	Lead Toxicosis	San Benito
681	U	4/14/2013	PINN	Missing, chick - unrecovered	NA
345	M	5/29/2013	PINN	Lead Toxicosis	San Benito
686	U	6/1/2013	VWS	Undetermined, chick recovered in desiccated state, died in nest	Monterey
335	M	6/5/2013	PINN	Lead Toxicosis	San Benito
306	F	6/9/2013	PINN	Electrocution (possible indirect lead exposure)	Monterey
715	U	6/21/2013	VWS	Missing (disappeared shortly after hatch)	NA
332	M	7/3/2013	PINN	Lead Toxicosis	Fresno
194	F	7/5/2013	VWS	Missing (last detected 7/10/2013)	NA
708	U	7/12/2013	VWS	Trauma, chick died in nest	Monterey
313	M	8/8/2013	PINN	Lead Toxicosis	San Benito
714	U	8/28/2013	VWS	Trauma, chick died in nest	Monterey
693	U	9/8/2013	PINN	Missing, chick - unrecovered	NA
501	F	10/1/2013	VWS	Missing (last detected 9/25/2013)	NA
451	M	12/7/2013	PINN	Lead Toxicosis	San Benito
739	U	4/28/2014	VWS	Missing, chick - unrecovered	NA
400	F	4/29/2014	PINN	Lead Toxicosis	San Benito (Died at LA Zoo)
401	M	6/15/2014	PINN	Lead Toxicosis (proximate) perforation of the ventriculus (immediate)	San Benito (Died at LA Zoo)
444	F	8/26/2014	VWS	Lead Toxicosis	San Benito
753	M	10/1/2014	VWS	Missing (disappeared shortly after fledging)	NA
411	M	12/6/2014	PINN	Undetermined: bird recovered in desiccated state	San Benito
664	F	12/31/2014	VWS	Lead Toxicosis	San Benito
788	U	4/25/2015	VWS	Missing, chick - unrecovered	NA
798	U	5/1/2015	VWS	Missing, chick - unrecovered	NA
713	M	5/15/2015	PINN	Missing (last detected 5/15/2015)	NA
782	F	5/31/2015	PINN	Missing, chick - unrecovered	NA
242	M	7/30/2015	VWS	Lead Toxicosis	Monterey
769	F	8/29/2015	VWS	Trauma from powerline collision	Monterey
615	M	11/17/2015	VWS	Trauma - Predation	Monterey
481	F	4/22/2016	PINN	Missing (last detected 4/21/2016)	NA
742	F	5/1/2016	PINN	Septicemia	San Benito (Died at LA Zoo)

251	M	7/11/2016	VWS	Lead Toxicosis	Monterey
838	U	12/1/2016	VWS	Trauma, fledgling euthanized due to injuries	Monterey
514	M	3/17/2017	PINN	Anticoagulant toxicity	Fresno
534	F	4/17/2017	PINN	Missing (last detected 4/16/2017)	NA
583	F	6/28/2017	VWS	Missing (last detected 6/27/2017)	NA
703	M	7/6/2017	VWS	Lead Toxicosis	San Benito
460	F	7/7/2017	PINN	Egg binding	Monterey
597	F	7/19/2017	VWS	Drowning	San Luis Obispo
760	F	7/19/2017	VWS	Drowning	San Luis Obispo
525	F	8/1/2017	PINN	Lead Toxicosis	Monterey
787	F	12/24/2017	VWS	Drowning	Monterey
614	F	1/19/2018	PINN	Lead Toxicosis	San Benito
687	F	5/22/2018	PINN	Missing (last detected 5/21/2018)	NA
706	M	6/11/2018	VWS	Lead Toxicosis	Monterey
684	F	1/30/2019	PINN	Missing (last detected 1/29/2019)	NA
351	M	4/27/2019	PINN	Electrocution: Bird electrocuted on line (mid-span)	Monterey
835	F	6/7/2019	PINN	Lead Toxicosis	Monterey
744	F	6/22/2019	PINN	Lead Toxicosis	San Benito
418	F	7/1/2019	PINN	Lead Toxicosis	San Benito
795	F	10/8/2019	PINN	Lead Toxicosis	San Benito
799	F	11/27/2019	VWS	Lead Toxicosis	Monterey
842	F	12/22/2019	VWS	Lead Toxicosis	San Benito
559	M	12/30/2019	VWS	Lead Toxicosis	San Benito (Died at LA Zoo)
463	M	1/5/2020	PINN	Lead Toxicosis	San Benito (Died at LA Zoo)
199	M	1/16/2020	VWS	Lead Toxicosis	Monterey
222	F	1/22/2020	VWS	Missing (last detected 1/21/2020)	NA
991	U	4/3/2020	VWS	Missing (last detected 4/2/2020)	NA
405	M	4/25/2020	PINN	Lead Toxicosis	Monterey
906	F	5/14/2020	VWS	Electrocution: Bird electrocuted on line (mid-span)	San Luis Obispo
231	F	5/21/2020	VWS	Missing (last detected 5/20/2020)	NA
878	F	6/28/2020	PINN	Gunshot	Fresno
310	F	7/26/2020	PINN	Missing, mortality signal detected, unrecovered	NA
785	M	8/10/2020	PINN	Suspect Lead Toxicosis	San Benito
167	M	8/21/2020	VWS	Missing (Dolan Fire, presumed dead)	NA
375	F	8/21/2020	VWS	Missing (Dolan Fire, presumed dead)	NA
448	M	8/21/2020	PINN	Missing (Dolan Fire, presumed dead)	NA
678	F	8/21/2020	VWS	Missing (Dolan Fire, presumed dead)	NA
773	M	8/21/2020	VWS	Missing (Dolan Fire, presumed dead)	NA
789	M	8/21/2020	VWS	Missing (Dolan Fire, presumed dead)	NA
875	F	8/21/2020	VWS	Missing (Dolan Fire, presumed dead)	NA
992	F	8/21/2020	VWS	Missing (Dolan Fire, presumed dead)	NA
1004	F	8/21/2020	VWS	Missing (Dolan Fire, presumed dead)	NA

1022	U	8/21/2020	VWS	Missing (Dolan Fire, presumed dead)	NA
1029	U	8/21/2020	VWS	Missing (Dolan Fire, presumed dead)	NA
874	F	8/28/2020	PINN	Lead Toxicosis	Monterey
823	F	9/12/2020	VWS	Lead Toxicosis	San Benito (Died at LA Zoo)
909	M	10/2/2020	PINN	Undetermined, only wings recovered	San Benito
543	F	10/9/2020	PINN	Lead Toxicosis	Monterey
567	M	10/11/2020	VWS	Lead Toxicosis	Monterey (Died at LA Zoo)
547	F	10/29/2020	PINN	Missing (last detected 10/28/2020)	NA
1030	U	11/2/2020	VWS	Missing (disappeared shortly after fledging)	NA
564	M	11/7/2020	PINN	Lead Toxicosis	San Benito (Died at LA Zoo)
688	M	1/6/2021	PINN	Lead Toxicosis	Stanislaus
901	M	1/17/2021	VWS	Euthanized due to burns from Dolan Fire	San Benito (Died at LA Zoo)
824	M	1/24/2021	VWS	Lead Toxicosis	San Benito
877	M	2/2/2021	PINN	Lead Toxicosis	San Benito (Died at LA Zoo)
606	M	3/4/2021	PINN	Lead Toxicosis	San Benito
431	M	5/3/2021	PINN	Lead Toxicosis, euthanized	San Benito (Died at LA Zoo)
728	F	5/9/2021	PINN	Lead Toxicosis (proximate cause), drowning (immediate cause)	Monterey
704	M	5/19/2021	PINN	Lead Toxicosis	San Benito
725	F	6/6/2021	PINN	Lead Toxicosis	Monterey
438	F	7/1/2021	PINN	Undetermined, advanced decomposition	San Benito
974	M	7/6/2021	VWS	Disease, infection air sacculitis	San Luis Obispo
311	F	7/24/2021	VWS	Lead Toxicosis	Monterey
1077	U	8/1/2021	VWS	Missing, chick - unrecovered	Monterey
961	F	9/4/2021	PINN	Lead Toxicosis	San Benito
915	F	1/16/2022	VWS	Electrocution	San Benito
716	M	3/21/2022	VWS	Missing	NA
825	F	4/5/2022	PINN	Undetermined	San Benito
1096	M	4/15/2022	PINN	Bacterial Infection	San Benito
837	M	4/23/2022	VWS	Lead Toxicosis	Monterey
828	F	5/4/2022	PINN	Suspect Lead Toxicosis	Monterey
1038	F	5/22/2022	VWS	Trauma	Monterey
972	M	7/2/2022	PINN	Necropsy report pending - gunshot	San Benito
968	M	1/5/2023	VWS	Lead toxicosis	San Benito (Died at LA Zoo)
1082	F	1/6/2023	PINN	Trauma, entrapment in landslide	San Benito
700	M	1/21/2023	PINN	Lead Toxicosis	San Benito
697	M	1/28/2023	VWS	Lead Toxicosis, died in captivity during treatment	San Benito (Died at LA Zoo)
711	M	2/13/2023	VWS	Trauma - sharp force inter/intraspecific conflict suspected	Monterey
1195	U	4/28/2023	PINN	Missing, chick - unrecovered	San Benito

663	M	6/8/2023	VWS	Undetermined	Monterey
1231	U	6/11/2023	VWS	Missing, chick - unrecovered	Monterey
1230	U	7/20/2023	VWS	Missing, chick - unrecovered	Monterey
696	M	9/14/2023	VWS	Lead Toxicosis	San Benito
602	M	11/21/2023	PINN	Lead Toxicosis	San Benito

APPENDIX B – RADIOGRAPH AND CHELATION SUMMARY OF PINNACLES-MANAGED CONDORS, 2023

Radiographs listed chronologically. One VWS-managed condor, 956, was radiographed at PINN and included on this list.

Date	Bird ID	Location	Purpose	Metallic Density	Outcome	Chelated
4/26/2023	1145	PINN	Lead Exposure	Possibly	Possible small metallic density in GI tract	Yes
4/27/2023	1145	PINN	Lead Exposure	No	Possible metallic density no longer present	Yes
8/30/2023	330	PINN	Lead Exposure	No		Yes
10/11/2023	956	PINN	Medical Concern	No		No
11/22/2023	692	PINN	Lead Exposure	Yes	2 spherical metallic densities in left leg and 1 possible metallic fragment in GI	Yes
11/22/2023	1060	PINN	Lead Exposure	No		Yes
11/25/2023	692	PINN	Lead Exposure	Yes	3 round, metallic pellets in body (2 in left leg and 1 in right wing) and 1 possible metallic fragment in GI	Yes
12/2/2023	692	LA Zoo	Lead Exposure	Yes	Multiple radiographs and at least 5 possible metallic densities: 1 in lower left side mandible, 1 possibly in lower leg, 1 in GI tract, 1-2 in upper leg, and 1 in right secondary feather shaft (extracted).	Yes
12/7/2023	1060	LA Zoo	Lead Exposure	No		Yes
12/18/2023	692	LA Zoo	Lead Exposure	Yes	Multiple radiographs. Metallic density in GI tract no longer present. The densities originally thought to be in the leg were found to actually be in feathers. Metallic pellets located and extracted from lower beak, alula area of right wing, and right-side tail feather. Two remaining pellets located in the primary feather shafts were located but not extracted.	Yes

12/20/2023	1060	LA Zoo	Lead Exposure	No		Yes
12/28/2023	1081	PINN	Medical Concern	No	Prior behavior suggestive of clinical lead toxicosis, but radiograph was clear of any unusual metallic densities. Held for observation without chelation.	No

APPENDIX C – SCIENTIFIC PUBLICATIONS WITH PINNACLES NATIONAL PARK EMPLOYEE CO-AUTHORS

Bakker, V. J., M. E. Finkelstein, D. F. Doak, R. Wolstenholme, A. Welch, J. Burnett, A. Punzalan, J. Brandt, S. Kirkland, N. E. Seal Faith, E. R. Lehnert, and E. A. Sandhaus (2023). Lead, trash, DDE, and young age of breeders linked to lower fertility in the first two decades of reintroduction for critically endangered California Condors in California. *Ornithological Applications.* 125:duad022.

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Herring, G., Eagles-Smith, C.A., Bedrosian, B., Craighead, D., Domenech, R., Langner, H.W.,…Parish, C.N. (2018). Critically Assessing the Utility of Portable Lead Analyzers for Wildlife Conservation. *Wildlife Society Bulletin.*

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