

Pinnacles National Park
California Condor Reestablishment Program
Annual Report 2020



Pinnacles National Park Report
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Prepared by:

Alacia Welch, Acting Condor Program Manager

Rose Fielding, Condor Field Crew Leader

Gavin Emmons, Raptor/Condor Biologist

Daniel Ryan, Invasive, Wildlife Biologist/Non-Lead Ammunition Specialist

National Park Service

Pinnacles National Park

5000 Highway 146

Paicines, CA 95043

Submitted to USFWS January 29, 2021

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Alacia Welch, Acting Condor Program Manager

Cover photo: *Condors 236 and 340 intertwine necks guarding nestling 1027 behind them after successful handling. NPS Photo by Gavin Emmons.*

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Volunteers

Rakesh Agarwal, Mike Baird, Joseph Belli, Daniel George, Megan Gnekow, Barbara Lutes, Bob Quaid, Devii Rao, Gene Rhough, Jeff Robinson, and Darryl Zimmerman

Interns

Maddi Burns, Isaac Henderson, Kaitlin Lopez, Sarah Marquez, and Danaé Mouton

INTRODUCTION

California condors are one of the rarest bird species in the world and biologists have been committed to their recovery for over four decades. The Condor Reestablishment Program at Pinnacles National Park (PNP) 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 reproduction;
- detecting mortalities and recovering condor carcasses so cause of death can be determined;
- managing threats to condors;
- increasing public awareness of threats to condors; and
- conducting cooperative research to aid condor recovery.

Together with Ventana Wildlife Society (VWS), PNP manages a flock of 93 condors in central California. During 2020, PNP monitored all birds inhabiting the central California area, as well as PNP-managed condors that traveled beyond their typical range. PNP-managed condors and VWS-managed condors make up a single flock, overlap in range, feed together, and are captured at three release sites: one in the park and two in the Big Sur mountains. This report focuses on Pinnacles Condor Program management of birds released from the park and, where appropriate, includes VWS-managed condor data, courtesy of VWS. Items of particular interest from the year are highlighted in Appendix A.

A summary of the year 2020 would be incomplete without addressing the impacts of the COVID-19 pandemic on operations and management. While the condors themselves were not directly affected by the virus, the effort to manage them was modified in numerous ways. Essential activities like providing food for condors in captivity and those recently released were maintained with measures to reduce transmission of COVID between crew members. Starting in March, all operations and programmatic needs were assessed to reduce risk of exposure and transmission between staff members. Additionally, shelter-in-place orders and quarantine guidelines were taken into consideration and followed while also balancing the essential activities required for managing an endangered species, including those in captivity. Staff wore personal protective equipment (PPE) for all activities when multiple people were in close proximity, including face coverings or KN95 masks in addition to all other PPE.

Condor field activities changed in numerous ways to minimize risk of transmission. Solo tracking of condors within the park continued, although less often in high visitor-use areas like the High

Peaks Trail. Crew members tracked outside the park only when trying to locate condors missing greater than five or six days in order to minimize time at gas stations and public bathrooms. Placement of carcasses at bait stations and captive pen were reduced to once per week, from twice a week, for part of the year.

COVID-19 mitigations also impacted trapping and handling protocols. Multiple people are required to work in close proximity while handling condors, so every effort was made to reduce the amount of time required while also balancing other safety measures and condor management requirements. As a result, instead of attempting to capture every condor this year, only those in need of new transmitters or showing signs of illness were prioritized. The chelation protocol was modified so that if a condor had an elevated blood lead level but a clear radiograph, it could be released. Additionally, any condor requiring chelation was taken to a zoo for treatment rather than being treated on site.

With all of these measures in place, the Pinnacles Condor Program successfully mitigated the risks of transmitting COVID-19 while also balancing the requirements of managing critically endangered California condors.

METHODS

Population Monitoring

Condors are monitored year-round to document reproduction, mortality, and movements. Condor health, foraging, interactions, and breeding behavior are monitored through visual observations. Biologists use standard equipment to radio-track and locate condors. A detailed equipment list is available in: *Pinnacles National Park California Condor Reestablishment – Annual Report 2013. Pinnacles National Park, National Park Service, Paicines, California. Pp. 20.*

Survival Monitoring

Most condors managed by PNP are monitored remotely via GPS transceivers, or “GPS tags,” on their wings (Figure 1). Argos satellite GPS data are downloaded daily from Woods Hole Group and mapped in ESRI ArcMap version 10.6. PNP also deploys GSM (cellular technology) GPS tags manufactured by Microwave Telemetry (MT). Data



Figure 1, GPS tag on condor.
NPS Photo by Gavin Emmons.

from MT GSM tags are received via email when a tagged condor flies within range of a cellular tower. Both satellite and GSM data are viewed through Movebank's online interface. PNP staff uses ArcGIS and Google Earth to map and view all condor location data daily. PNP uses a greater proportion of Argos satellite tags over GSM tags due to poor cellular coverage in the central California condor range.



Figure 2, Condor volunteer, Mike Baird, scans for condor radio signals in the High Peaks.
NPS Photo by Gavin Emmons.

Radio tracking within and around PNP is conducted five to seven days per week. Biologists track at higher elevations to increase probability of detecting a signal (Figure 2). Monitoring outside of the park is conducted along public roads in San Benito County, portions of western Fresno County, northern San Luis Obispo County, and eastern to southern Monterey County. Prolonged stationary GPS locations or mortality signals (triggered by a radio transmitter that is immobile for at least four to ten hours, depending on manufacturer) are located to confirm dropped

tags or the presence of sick or deceased condors. 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. PNP follows US Fish and Wildlife Service (USFWS) condor carcass collection procedures. All field data is recorded in Microsoft Access databases. Additionally, summary data of daily monitoring activities are entered into a secure online database shared with research and management cooperators.

Trapping

Trapping condors is critical to maintain vinyl identification tags and functioning VHF radio and GPS tags on as many individuals as possible. PNP conducted trapping in 2020 to measure condor blood lead levels, replace transmitters, and collect samples for ongoing research studies.

Before handling condors, biologists receive extensive training in handling protocols, collecting samples, and processing birds from highly experienced LA Zoo keepers and PNP staff who are already listed on PNP's USFWS recovery permit as



Figure 3, Crew member holding Condor 961 with new transmitter and vinyl tag.

NPS Photo by Gavin Emmons.

approved handlers. Personal protective equipment (PPE) during handling includes eye protection, long-sleeved shirts and pants, closed-toe boots, and leather and nitrile gloves (Figure 3). When COVID-19 protocols were implemented, all crew members wore face coverings or KN95 masks in addition to regular PPE.

Nest Monitoring and Reproduction

PNP 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 PNP while those to the west are managed by VWS.

Biologists monitor active nest sites from observation points located 300-800 meters from the nest depending on topography. They look for egg incubation, hatching, nestling health, behavioral interactions, adult-nestling feeding events, and fledging of young. Where feasible, biologists enter active nests following standard procedures for egg candling as well as nestling health checks, conducted at 45-60 and 120 days of age.

Once a nest site is confirmed, biologists may enter the nest to check the fertility of the egg. They use a high-powered flashlight in a dark space to view inside the egg. If an egg is fertile, it is left in the nest. If an egg is not fertile, it is removed and may be replaced with an artificial egg until an egg laid in captivity is available to replace the artificial one. Access to nests on private property, nest location, parent and nestling



Figure 4, Rose Fielding collects nest trash.
NPS Photo by Gavin Emmons.

behavior or health, and staff capacity may result in changes to planned nest entries to ensure safety for the field crew as well as the condors.

During nest entries, PPE includes all appropriate climbing equipment, eye protection, 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. If a nestling has high lead exposure, it may be evacuated from the nest for emergency care or monitored more closely.

Biologists search and/or sift nest sites for eggshell fragments and trash, which are removed when found (Figure 4). Annual nest entry trainings are conducted at PNP and additional technical ropes trainings are planned year-round to maintain staff experience with relevant technical skills.

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 inside of the nest 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 cavity, they enter the nest for an egg fertility check and 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 secured inside or next to the nest. A microwave antenna is also powered with the solar power system and sends the video signal to a receiving antenna connected to a computer running video recording software. This software allows multiple days of video to be viewed live or at a later time.

Nest video cameras greatly increase the number of hours of nest observations, enhance the quality of observations, and reduce the amount of time field biologists spend hiking to remote nests. The cameras allow biologists to observe nestling health, nestling-parent interactions and other important events that would otherwise not be observed.

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. 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 include the captive pen and Hilltop semi-permanent bait site which are in an area of the park closed to the public. 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 interactions with condors and association with humans as food suppliers.

Remote Monitoring

Remote video cameras stationed at the captive pen and Hilltop bait site record during daylight hours, allowing biologists to perform physical checks on individual birds, observe condor interactions, and document feeding patterns. Memory cards from motion-triggered remote cameras are retrieved each time food is placed and the photographs are reviewed for presence of birds and predators. Photos and video recordings allow biologists to track the general condition of condors and document those without functioning GPS or radio transmitters.

Non-proffered Food

Non-proffered food is any carcass that PNP or VWS biologists have not placed for condors at bait sites. 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 only contacted about a carcass on their property when there is a specific concern.

Captive-reared Releases

PNP receives young condors from any of four captive breeding centers: Los Angeles Zoo, San Diego Zoo Safari Park, Oregon Zoo, and Peregrine Fund's World Center for Birds of Prey. Typically, PNP receives these birds in early fall when the condors are about a year and a half old. Depending on where the juvenile condors come from, they may be driven to the park or flown to a nearby airport by volunteer LightHawk pilots. When captive-reared young condors first arrive at PNP from the breeding centers, they spend at least 60 days in the PNP captive pen prior to their release to the wild (Figure 5). They are "soft released", which means they are not caught and released by hand. Instead, they move on their own into one of two traps that have both an inner and outer door. Once the condor steps through the inner door, a crew member



Figure 5, PNP captive pen with six captive condors perched inside and one free-flying condor perched on top. NPS Photo by Gavin Emmons.

that is out of view behind a wall and one-way glass closes that door and then opens the outer door to release the bird. This soft release method helps condors transition into the wild with the least amount of stress. Releasing these young condors is vital for bolstering the wild population.

Monitoring Captive Birds

Condors are held at PNP's captive pen as needed for flock management. An electrified power pole at the pen delivers negative reinforcement to discourage them from landing on power poles when in the wild. During handling and prior to initial release of young juveniles, biologists monitor condor health and interactions at the pen.

Missing Birds

When a condor goes undetected via visual observation, VHF radio signals, camera/video images, or GPS data for over a week, monitoring efforts increase by extending the radio-tracking search area and planning aerial telemetry flights through partner organizations or contractors. 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.

Management

The main threat to central California condors 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, West Nile Virus, and direct human interactions. PNP biologists conduct management with established protocols to study and reduce the impacts of these risks.

Lead Sampling

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. LeadCare Analyzers, suitable for field use, are used to obtain immediate results that determine whether a condor requires treatment for high blood lead levels (Figure 6). The lead treatment protocol for PNP-managed condors changed temporarily in 2020 to address the risks associated with COVID-19. In prior years, the threshold used to initiate chelation treatment was a blood lead value of 35 µg/dL or greater. Condors with elevated blood lead levels on a LeadCare II Analyzer were radiographed in the park's Condor Care Unit (CCU), at zoos, or clinics to help inform treatment needs. Birds with possible

metallic densities in their gastrointestinal tracts, or those with blood lead levels $>65 \mu\text{g}/\text{dL}$, were transported to the Oakland or LA Zoos for treatment. Condors with clear radiographs and blood lead levels between $35\text{--}65 \mu\text{g}/\text{dL}$ were treated at PNP when there was sufficient staff capacity to care for birds daily. In addition, condors with clear radiographs and blood lead levels between 25 and $35 \mu\text{g}/\text{dL}$ may have been monitored in the captive pen for two weeks at PNP for a lead depuration study.

In 2020, condors with blood lead values greater than $40 \mu\text{g}/\text{dL}$ and not exhibiting clinical signs of lead toxicosis were radiographed in the CCU. If the resulting image showed any metallic densities, the condor was transported to a zoo for chelation treatment. If not, it was released. Some condors that had lead levels $>65 \mu\text{g}/\text{dL}$ were taken directly to zoos for treatment without first being radiographed at PNP.

As in previous years, 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 instructed to do so, but are shipped to a lab for analysis. PNP staff have approval from NPS Biological Resources Division (BRD) staff on their Institutional Animal Care and Use Committee (IACUC) permit to allow VWS treatment protocols to be applied when VWS-managed condors are trapped in the park.

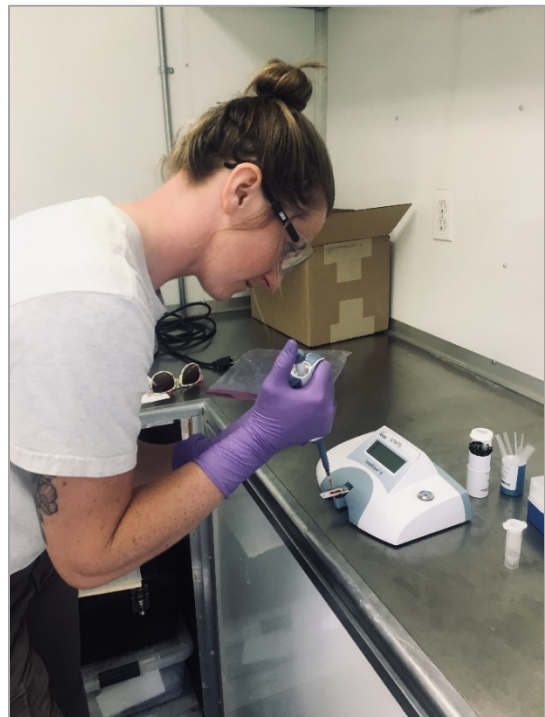


Figure 6, Kris Dudus uses LeadCare II Analyzer.
NPS Photo by Rose Fielding.

Veterinary care

PNP 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 clinic, or at a zoo.

Vaccination

Captured condors receive West Nile Virus vaccinations and boosters on a schedule provided by veterinarians. In 2020, 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 while still in the nest. This protocol was followed for all captured birds and for nestlings where nest entries were possible.

Hazing

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

Personnel

Implementing a long-term endangered species recovery program requires consistent staff capacity with highly trained, experienced biologists. This program is successfully staffed by a program manager, two field crew leaders, a biological science technician, 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. PNP's invasive wildlife biologist also works throughout the year part-time on wildlife health issues and non-lead ammunition outreach.

Volunteers provide vital program support and receive extensive training prior to assisting in the field. They 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 management of the species.

Collaborative Research

In 2020, PNP biologists continued to work closely with researchers at Colorado State University (CSU) on a spatial risk analysis, Montana State University (MSU) on a population viability and management analysis, and the University of California at Santa Cruz (UCSC) to measure condor responses to environmental risk factors. PNP also worked with US Geological Survey (USGS) and Integral Ecology Research Center to study potential impacts of rodenticides on condors.

Outreach

The PNP 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 PNP and local residents. Building a foundation of trust and cooperation can lead to partnerships, with the goal to steward 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, PNP Condor Program staff continued 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 7). PNP has dedicated half the time of one biologist to conduct outreach and work closely with the Institute for Wildlife



Figure 7, An example of a nonlead outreach booth.
NPS photo by Daniel Ryan.

Studies (IWS), VWS, The Peregrine Fund, Oregon Zoo, Great Basin Institute, and other partners to collaborate on outreach efforts. Additionally, during routine fieldwork, Condor Program employees, interns and volunteers speak with park visitors and local residents. Outreach is conducted in the local community, statewide, and at larger scales in coordination with other partners and NPS 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 game species. Condors benefit from related water resources, as well as the availability of nesting and foraging habitat. Carcasses or parts left on the land from hunting and ranching operations are an important food source for condors. The success of condor recovery will rely on the trust-based relationships developed with the hunting and ranching communities and the resulting fostered ownership of wildlife health.

PNP's outreach message is focused on how condors benefit from hunting and ranching operations when non-lead ammunition is used. PNP staff discuss available alternatives to lead ammunition with hunters and ranchers, as well as how to achieve the best performance from non-lead ammunition. Additionally, they communicate with other land management agency staff the benefits of reducing wildlife lead exposure from external and internal actions, and how to change internal practices. Staff also highlight the need for continued hunting and ranching with park visitors and the general public, as well as how those traditions play an important role in wildlife conservation.

RESULTS

Population Monitoring

In January 2020, PNP managed 36 of the 101 condors in central California, making up about 35% of the flock. Throughout the year there were 10 deaths, one condor was permanently transferred into captivity, five captive-reared juveniles were released, and three condors fledged. The total number of PNP-managed condors at the end of 2020 was 33, marking the second year in a row with a net loss.

Combined with condors managed by VWS, 93 birds occupied the central California area at the end of the year (Figure 8). In total, there were 12 nesting attempts, with nine of those including at least one PNP condor. Five nests fledged chicks with three managed by PNP and two by VWS.

As of December 2020, the ratio of adult males to females was weighted toward males, with 65% of the central California population male and 35% female. Adults are defined as those hatched in 2015 or earlier. There were three juveniles of unknown sex at the end of 2020, so it was difficult to get an accurate understanding of the juvenile male/female ratio. Not including the unknowns, the ratio of juvenile males to females is similar to adults, 67% male, 33% female. A couple of explanations for this skewed ratio include the facts that over the years more females died than males (49 females, 37 males and one unknown) and, broadly speaking, there are more males available for release from the captive breeding program into central California each year. If this demographic trend is an indicator of adult females having higher mortality than males, there are strong population growth implications in the short- and long-term.

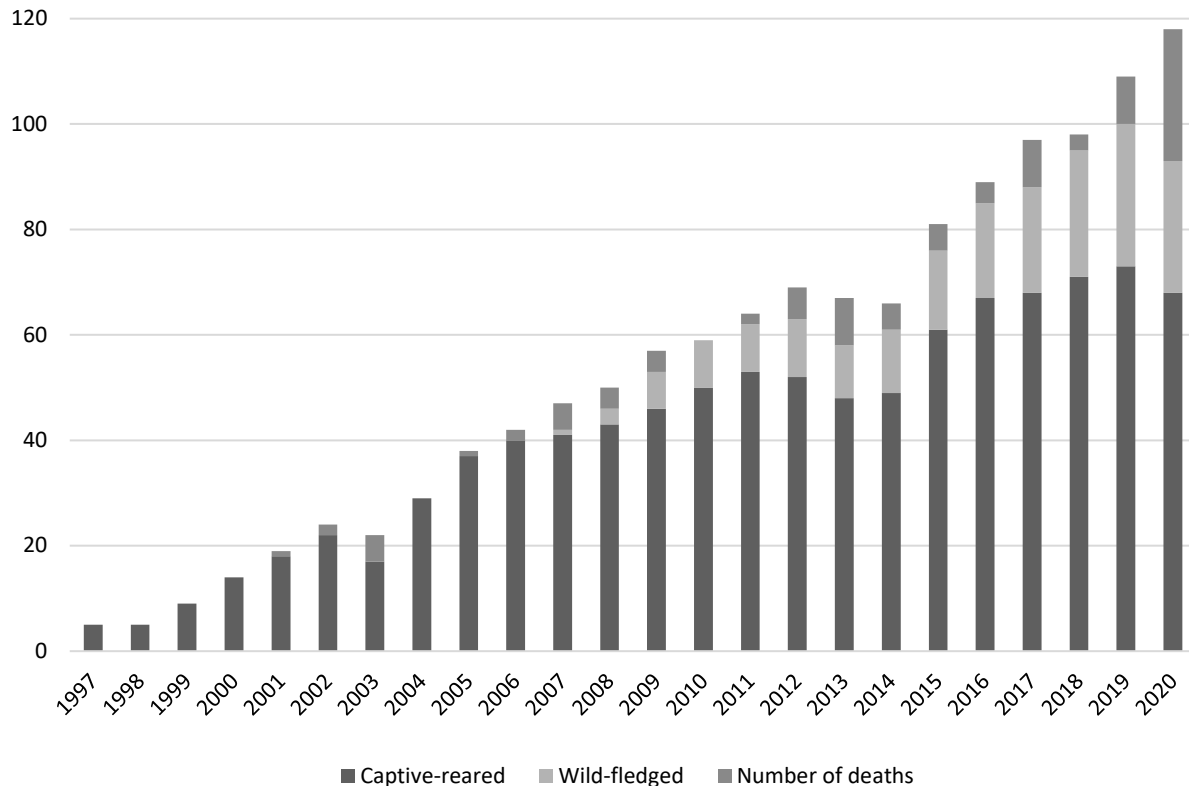


Figure 8, Summary of wild-fledged condors, captive-reared releases, and annual number of deaths in central California from 1997-2020. Chart presents total number of condors in the wild (both wild-fledged and captive-reared) currently managed by PNP and VWS in the central California area, in addition to the number of condor deaths each year. Note that condor nestling deaths are not included in this chart. VWS data provided by J. Burnett, Big Sur Condor Program Coordinator and Senior Biologist.

Survival Monitoring

Throughout the year, PNP staff monitored radio- and GPS-tagged condors almost daily. Condors without functioning tags were observed opportunistically. In 2020, there were 5,477 visual observations of wild condors by PNP biologists in the field. Whenever possible, biologists closely monitored any condor behaving abnormally and any bird with a GPS tag that did not move over 48 hours to determine if the individual was injured or sick.

Staff used GPS data to locate approximately 70% of PNP-managed birds daily and these data often directed where staff focused efforts for a given day. Hundreds of thousands of GPS locations were downloaded from GPS transmitters on 32 PNP-managed condors throughout the year. Condors released by both VWS and PNP used the landscape in all directions surrounding the park. Figure 9 maps a selection of satellite GPS location data from several PNP-managed condors and represents the core range used in central California in 2020. Because condors are social animals, monitoring them via GPS tags adds greater efficiency to locating all released condors, including those without functioning radio transmitters or GPS tags.

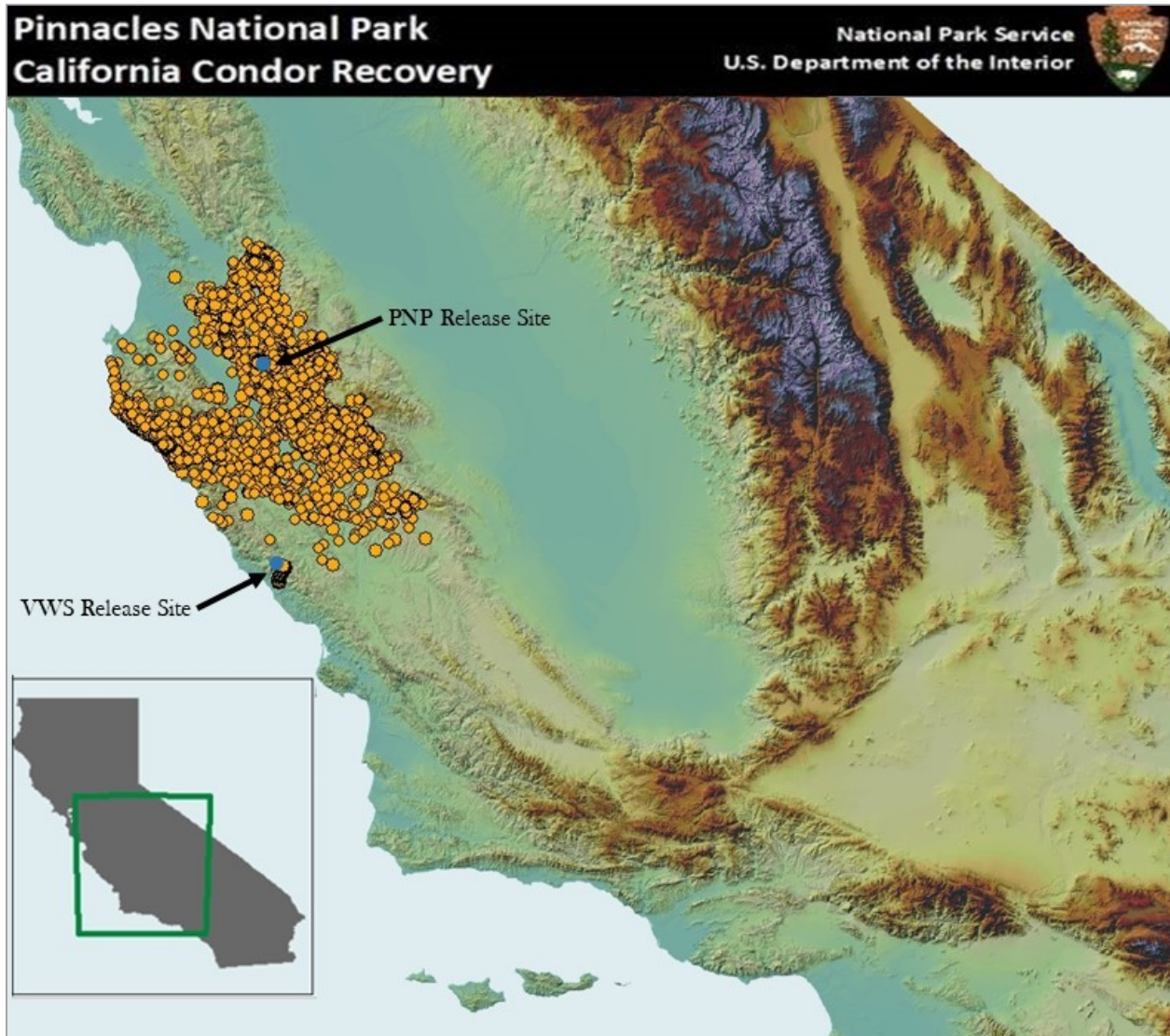


Figure 9, Typical range of PNP-managed condors in 2020, as indicated with amber dots.

Long Range Movements

In 2020, condor 828 took a long-range flight in July (Figure 10). She traveled from Pinnacles about 250 miles south to areas near the southern California condor release sites at Bitter Creek and Hopper Mountain National Wildlife Refuges. She explored the area for a few days and then returned to PNP and remained in central California for the rest of the year.



Figure 10, *Flight map of condor 828, track indicated with purple line.*

Mortality

In 2020, 10 PNP-managed condors died, representing 30% of the PNP flock, the highest rate of mortality in a year since the program began in 2003. These deaths bring the total loss for PNP-managed condors to 42 birds (Appendix B). Of the 10 deaths, two condors died in captivity while undergoing treatment for acute lead toxicosis, two were not recovered from the field, and the remaining six were retrieved and submitted to the USFWS Forensics Lab for necropsies. A cause of death was determined for four of the eight condors that were recovered and all were due to lead toxicosis (Figure 11). Two necropsy reports were pending at the end of the year.

One of the condors not collected likely also died from lead toxicosis. Condor 310 was captured by VWS and released showing no obvious clinical signs of lead poisoning and without a field lead test result. The lab lead result a few days after release was 860 µg/dL, equaling the highest level ever recorded in a PNP-managed condor. Soon after, the GPS transmitter on 310 indicated that she stopped moving in a remote area of the Ventana Wilderness. PNP staff attempted to reach that GPS location, detected a mortality signal as they approached, but could not retrieve her. Two months later, the Dolan Fire burned over the area of her last known location and no further attempts to collect her were possible.

The other condor not recovered from the field was Condor 448 who went missing along with eight VWS-managed condors and two nestlings when the Dolan Fire swept through a canyon in Big Sur near the VWS Condor Sanctuary in August (Appendix C). He was wearing a GPS tag when the fire engulfed his roost site and no further locational data was received, suggesting the tag and condor were overtaken by fire. PNP and VWS staff made every effort to locate all the condors missing after the Dolan Fire, but were not successful. All nine adults and two nestlings were declared dead after three months of searching and no contact.

Trapping

PNP trapping efforts were significantly reduced in 2020 due to protocol changes to address the COVID-19 pandemic. In total, 11 PNP-managed condors were trapped at both PNP and VWS facilities combined (not including condors handled in nests or caught in the wild). PNP staff spent 47 days trapping and captured 22 condors, including VWS-managed birds (Table 1).



Figure 11, Condor 874 as found, cause of death was lead toxicosis.

NPS Photo by Rose Fielding.

Year	Total handling days ^a	Total captures ^b	Total individuals captured ^c	Person Days ^d
2016	15	24	23	116
2017	20	45	45	150
2018	11	31	23	158
2019	27	96	50	171
2020	11	22	20	47

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

^aDays biologists initially handled any condors trapped at Pinnacles. These include condors caught for health checks, transmitter replacements, or as non-targets. Nestling handlings that took place at nests are not included.

^bNumber of condors trapped including multiple captures of the same individual in given year.

^cNumber of individual condors trapped during given year at Pinnacles.

^dNumber of person days refers to the number of days a staff member could have trapped a condor if a target condor went into the trap.

Nest Monitoring and Reproduction

In 2020, there were 12 nesting pairs or trios in central California and five fledged young, although two were unconfirmed visually by the end of the year (Table 2). PNP managed five of the nesting pairs and VWS managed seven. Of the PNP-managed nests, three were in the park, one on private land in Monterey County and another on private land in San Benito County. Three pairs successfully fledged young. The other two failed before hatch and the causes of these failures were unknown.

PNP Condor Nesting Details

PNP manages accessible condor nests to gain an understanding of the risks that may be present during nesting and to mitigate those risks. This includes potentially replacing infertile eggs with viable ones, monitoring the health of nestlings, providing care or treatment if needed, and the removal of any micro-trash found within nest cavities. Nesting results should be interpreted with this in mind. In 2020, biologists entered two of the PNP-managed nests and one of the

VWS-managed nests (Figure 12). They entered one of the PNP nests to install a video camera and check the fertility of the egg. The other PNP nest was entered to perform a 45-day health check on the nestling. Additionally, PNP staff entered one VWS-managed nest two times. The first entry was to place a tag and transmitter on the chick, but the team found the nestling had an elevated lead level and was significantly smaller than expected for its age. It was placed back



Figure 12, Gavin Emmons with Condor 1033 in nest cave.

NPS Photo by Alacia Welch.

in the nest and closely monitored thereafter. A month later, the Dolan Fire was threatening the nest, so PNP and VWS staff organized a second nest entry to evacuate the nestling and transfer it to captivity (Appendix C).

PNP used a remote video camera to monitor a new nest this year and captured interesting parental behavior after the egg failed to hatch. The parents eventually gave up and stopped incubating approximately three weeks after the egg was due to hatch. The egg sat in the cavity untouched for months, but later in the summer the male re-entered and ate the egg.

Nest ID	Nesting Male	Nesting Female	Egg ID	Estimated Lay Date	# of Nest Entries	Wild Egg Fate	Nestling Studbook	Nest Outcome
TC1	564	317	CC220	1/30	0	Hatched	1021	Fledge
TD1	700	678	CC120	2/5	0	Missing	---	Fail
UCG1	692	726	CC320	2/7	1	Did not hatch	---	Fail
HS2	448	543	CC520	2/7	0	Hatched	1022	Fail
Roos	219	231	CC1320	2/9	2	Hatched	1033	Evacuated
Castle	567	311	CC620	2/20	0	Hatched	1029	Fail
MAC5	340	236	CC420	2/21	1	Hatched	1027	Fledge
NM2	652	550	CC720	2/26	0	Hatched	1030	Fledge
AC	167	190	CC820	2/29	0	Hatched	1031	Post-fledge evacuation
SB6	606	747	CC920	3/1	0	Hatched	1034	Fledge
RC	663	438	CC1220	3/2	0	Did not hatch	---	Fail
RB2	566/711	725	CC1020	3/26	0	Did not hatch	---	Fail
TD4	700	678	CC1120	4/6	0	Did not hatch	---	Fail

Table 2, 2020 central California nesting summary in order by estimated lay date. VWS data provided by J. Burnett.

Central California Condor Nesting Trends Over Time

As the population in central California continues to grow, more condors reach breeding age each year, thus resulting in an overall increase in number of nesting attempts (Figure 13). Despite the increase in egg production, the number of fledglings plateaued at four to five per year since 2014.

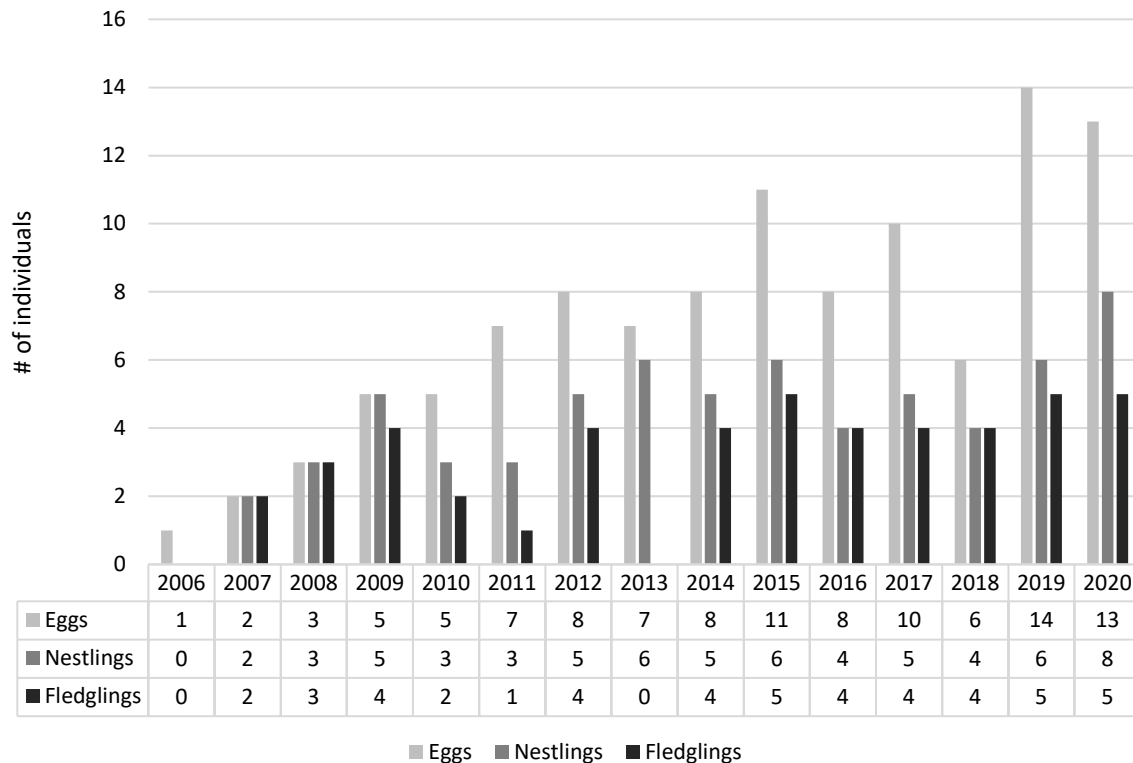


Figure 13, Multi-year central California condor nests: 2009-2020. VWS data provided by J. Burnett.

Microtrash

One nest in PNP contained two bottle caps and one piece of red plastic, which staff removed during a nest entry. In all, trash removed from nests over the years has included bottle caps and items made of plastic, rubber, cloth, and metal. Items weighed between .07 and 26.9 grams each.

Baiting

In 2020, biologists placed 157 calves procured from organic dairies near Modesto, California to bait the captive pen during trapping, feed captive condors and attract free-flying condors to a video-monitored bait site. During trapping seasons, carcasses were placed exclusively at the pen to increase trapping success.

Remote Monitoring

To supplement radio and GPS monitoring, staff collected and reviewed tens of thousands of remote motion-triggered photos and thousands of hours of video recordings. These remote cameras documented 3,809 sightings of individual free-flying condors throughout the year.

Non-proffered Food

In 2020, biologists and members of the public reported observations of four non-proffered feeding events that resulted in 23 observations of condors feeding on carcasses they found on

lands surrounding PNP. Many feeding events in the wild go unrecorded due to limited access to private land and the dispersed nature of animals across the landscape.

Captive-reared Releases

In 2020, PNP released five captive-reared juveniles, three in January and two in November. Two of the juveniles released in January succeeded in navigating the transition to the wild. Condor 872, however, did not fare well, and after not eating for a couple of weeks and failing to socialize with other condors was recaptured and transferred to the Santa Barbara Zoo in March. He will likely remain in captivity permanently.

The two condors released in November came from San Diego Zoo Safari Park and successfully transitioned into the wild upon release. Condor 961, named Xanan by zoo staff, will be featured in a children's book the zoo is developing about her journey from hatch to release into the wild (Figure 14).



Figure 14, Condor 961 "Xanan" perches in pine tree after release.
NPS Photo by Gavin Emmons.

Two additional condors from the World Center for Birds of Prey arrived at the park in November and should be released in early 2021.

These two condors were transported from Boise, Idaho to California by volunteer pilots with LightHawk, a non-profit organization dedicated to conservation.

Missing Birds

One PNP condor, 684, was missing since 1/29/2019 and declared dead in January 2020. This condor was added to the mortality total of 2019 (Figure 8).

Management

Lead Sampling

Blood lead sampling continued to be a priority for the entire central California condor population. Figure 15 summarizes the initial lab lead values for all condors in central California

since 2007. From 2008-2012, both PNP and VWS attempted to capture all birds twice per year for a research study. When the study concluded, the objective changed to trying to catch all condors at least once per year. In 2020, trapping efforts were reduced even further due to COVID-19 protocols. In total, 43 samples were taken from 38 condors. Of those, only 13 were PNP-managed.

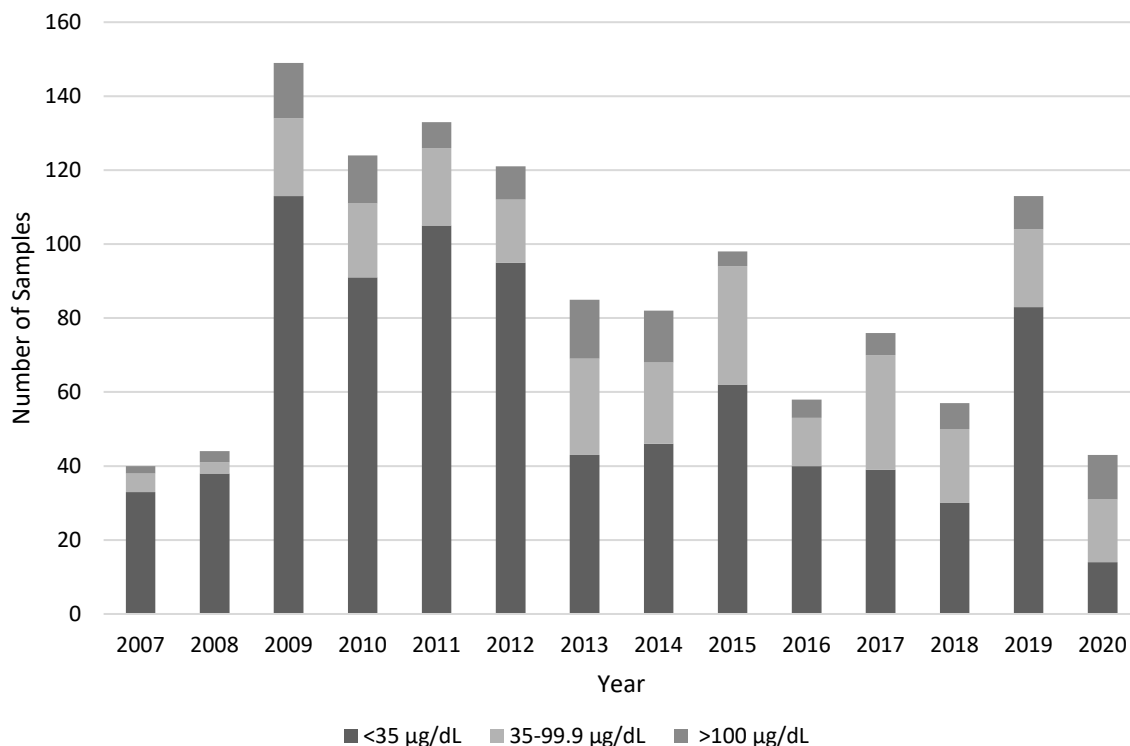


Figure 15, Blood level lab test outcomes in µg/dL for all central California condors: 2007-2020. VWS data courtesy of J. Burnett.

Veterinary Care

Radiographs and Chelation Treatments

In 2020, two condors with elevated blood lead values were radiographed at PNP, determined to be clear of metallic densities and released (Table 3). Oakland Zoo staff radiographed and chelated three PNP-managed condors with elevated blood lead levels who were not exhibiting signs of lead toxicosis. LA Zoo received one PNP-managed condor in late 2019 with clinical lead toxicosis that required intensive treatment and spent 10 months in recovery before re-release into the wild. They also radiographed and chelated an additional two condors from PNP: one with extreme lead toxicosis who did not survive treatment and another who recovered and was released.

Surgeries

In 2020, one PNP-managed condor was put under anesthesia twice to undergo crop flush procedures to remove metal fragments from the ventriculus and pro-ventriculus. No other surgeries were performed this year.

Condor	Location	Purpose	Metallic Density	Outcome	Chelated
431	PNP & Oakland Zoo	Lead Exposure	No	No metallic densities. Chelated and released.	Yes
564	LA Zoo	Lead Exposure	Yes	Multiple metallic densities. Chelated, underwent crop flushes twice, but did not survive.	Yes
589	PNP	Lead Exposure	No	No metallic densities, released.	No
602	Oakland Zoo	Lead Exposure	No	No metallic densities. Chelated and released.	Yes
688*	LA Zoo	Lead Exposure	Yes	One metallic density. Chelated, held for 10 months to recover and released.	Yes
704	PNP & Oakland Zoo	Lead Exposure	Yes	Two metallic densities. Chelated, cleared and released.	Yes
914	PNP	Lead Exposure	No	No metallic densities, released.	No
1006	LA Zoo	Lead Exposure	Yes	Multiple metallic densities. Chelated, cleared and released	Yes

Table 3. Radiograph and chelation information for PNP-managed condors in 2020. Note: table includes PNP birds radiographed either at PNP or elsewhere and any VWS birds that were radiographed at PNP.

*688 radiographed in December 2019, but chelation treatment and recovery continued into 2020.

Vaccination

In 2020, West Nile Virus vaccinations were administered to 10 PNP condors.

Hazing

In 2020, staff hazed three condors from locations that were deemed unsafe.

Personnel

In 2020, the program manager position was vacant for nine months and the biological science technician position lapsed. However, an additional intern was hired to cover field operation needs and volunteers continued to provide vital support. In total, 11 volunteers contributed 1,669 hours and five interns contributed 4,665 hours.

Collaborative Research

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

Chelation Efficacy

A PNP/UC Santa Cruz (UCSC) chelation efficacy research study began in 2015 to evaluate the benefits of chelation on condors over time in terms of reduced mortality. Blood and feather sample collection supports this effort. Evaluating lead concentrations and isotopic compositions in sequential feather segments from individual birds is providing data on the degree, frequency, and severity of lead exposures in condors. These data will be considered with chelation history of individual birds. When feasible, PNP biologists measure and mark at least one growing primary feather at the time of capture. Any previously marked feathers are sampled, if possible. Results will be published in a peer-reviewed journal. Because of the high value of data from feathers, PNP staff will continue to mark and collect samples for future research questions.

Chelation Treatment Impacts on Short-term Survival

In 2019, PNP and VWS, in collaboration with Montana State University (MSU) and UCSC, began a three-year study comparing survival of condors with and without treatment to asymptomatic lead exposure. All PNP-managed condors continue to be radiographed and chelated if field blood lead values are 35 µg/dL or greater. All VWS-managed condors are radiographed and chelated only if they show symptoms of lead exposure. Blood samples are taken for all PNP and VWS condors and submitted to a lab for 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 as a result of the pandemic starting in 2020, this research study may be extended an additional 1-2 years.

Population Viability Analysis (PVA)

MSU researchers have developed a PVA model with data and input from PNP, USFWS, VWS, UCSC for all condors in California, as well as the California condor studbook managed by staff at San Diego Zoo Safari Park. Initial results with data through 2013 were published in 2016 by Bakker, et al (Appendix D). The project continues to add all relevant data through 2019 to the

PVA and use it to inform management decisions through a Population Viability Management approach. The results help inform management decisions for release sites, captive rearing facilities and overall recovery strategies.

Blood Parasite Study

San Francisco State University (SFSU) researchers in collaboration with USFWS, VWS, and PNP, analyzed blood samples for parasites that may be associated with diseases, such as avian malaria. This study involved collecting a <1 ml blood sample from each condor in the central California flock. All 34 samples tested for avian malaria were negative and were free from other parasites. Data collection for this project was completed in 2018 and a written summary of results was received in 2020.

Rodenticide Exposure

Preliminary results from condor liver samples analyzed in recent years indicated that some condors were exposed to rodenticides and highlighted the need to continue research that began in 2014 on Prairie falcons at PNP. Collaboration between the NPS Washington Office, PNP, and US Geological Survey continued through 2020 and publication of results is expected in 2021.

In addition, Redwood National Park (REDW) and PNP collaborated with the Integral Ecology Research Center to conduct spatial modeling of central and northern California to map areas of high risk for illegal marijuana cultivation sites and their related toxins, particularly rodenticides. This work began in 2018 and the final report was received in 2020, Wengert, et al (Appendix D).

Condor Range and Movements Research

PNP's research collaboration with Colorado State University continued into 2020. Researchers analyzed condor behavior, environmental parameters, and condor GPS movement data to predict long term occupation of areas beyond their current range. The research will help managers better understand condor behavior as well as new and current threats that exist in areas not presently occupied by condors. Data analysis was completed in 2020 and a peer-reviewed journal publication is expected in 2021.

Condor High-Use Areas and Powerlines Assessment

Building on previous research assessing powerline infrastructure and condor activity, PNP partnered with UCSC and MSU researchers to overlay condor high-use areas with power distribution lines in central California. The results of this study will help managers partner with power companies to mitigate risks to condors. Results are expected in 2021 and peer-reviewed publication in 2022.

Outreach

A large component of PNP's Condor Recovery Program is educational outreach and interpretation. As the only condor release site in a national park, park visitation gives staff an opportunity to reach thousands of people from all over the world. Providing the public with information about the natural resources in the park and the surrounding landscape is an essential pathway to inspire environmental stewardship and enthusiasm and is one of the responsibilities of a national park.

NPS Education and Interpretation

Although 2018 was the final year of a three-year, multi-park project to ensure that all national parks with condors have consistent messages and interpretive materials, efforts have continued. NPS staff from Sequoia & Kings Canyon, Grand Canyon, and Pinnacles National Parks are working together to create an NPS-wide condor website that is set to launch in 2021. This site will be a source of accurate and consistent information about condors and will include tips for seeing condors in all the national park units that took part in this Parks Unite project.

PNP also 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 with informal interpretation about condors. In 2020, condor staff and volunteers spoke with 2,100 park visitors within the park and 25 individuals while tracking outside of the park boundary.

Outreach about lead as an environmental contaminant is recognized as one of the most important actions that can positively impact condor recovery. PNP 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.

Focused Non-lead Ammunition Outreach

This year PNP continued conducting outreach related to the use of non-lead ammunition and lead poisoning in scavenging wildlife due to inadvertent ingestion of spent ammunition in animal remains left in the field. The biologist hired by PNP in 2019 with half his time dedicated to non-lead outreach continued to build on efforts from past years while initiating new projects. PNP continued to collaborate with partners working in non-lead outreach around the country. This collaboration was especially important in 2020 due to capacity reductions and limitations associated with the COVID-19 pandemic.

PNP, with its many partners, is committed to building on its 15-year long effort to help hunters and ranchers switch to non-lead ammunition options through education and growing positive

relationship. 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. Early in 2020, trends in California ammunition availability showed positive gains in demand for non-lead ammunition with some stores offering more non-lead options than lead. As the pandemic set in, ammunition and firearm purchases increased dramatically, and ammunition shortages of all types made assessments of product demand and choice extremely difficult. However, manufacturers continue to develop and market more non-lead options, with every major ammunition manufacturer offering at least one non-lead option, and some new manufacturers that only develop non-lead loads.

In 2020, after the full implementation of CA Assembly Bill 711, which required non-lead ammunition for the take of all wildlife species in California, the state linked its hunting webpage to a website collaboratively run by multiple non-lead outreach coordinators. This site, huntingwithnonlead.org, provides detailed information and scientific studies on non-lead ammunition and the effects of lead on wildlife. In California, due to the combination of AB711, a national shortage of ammunition as a result of the pandemic, and California's "Safety For All Act" requiring face to face transfers of ammunition, much of the outreach in the state was 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 for the year.

Many outreach events still occurred in the early part of 2020 before pandemic-related restrictions ended in-person opportunities. At events such as hunting expositions, hunting club meetings, shooting demonstrations, and ranchers' workshops, thousands of individuals were reached directly in northern and central California. As restrictions continued, most outreach efforts in the state pivoted to virtual or socially distanced small groups as well as an internal focus on development of digital outreach content.

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 specifically focused on agency wildlife management in 2020. Trainings across the country on non-lead ammunition and wildlife dispatch worked to align NPS units with service-wide guidance. An emphasis on assisting parks with culling operations using

volunteers resulted in a successful partnership with Olympic National Park for their program using skilled volunteers to remove mountain goats (Figure 16). Non-Lead ammunition is required by the NPS for removal operations, so the PNP outreach biologist and non-lead specialist from Oregon Zoo held training and ammunition demonstrations to teach volunteers about the positive impacts of using non-lead ammunition while ensuring that everyone had the knowledge to be successful.



Figure 16, NPS volunteer traverses difficult terrain during mountain goat removal project at Olympic NP.

Photo courtesy of Russell Kuhlman.

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 increased monitoring efficiency by reducing the number of missing birds that were difficult to locate and by guiding the field crew's efforts after viewing GPS data each morning. Keeping 80-90% of PNP-managed condors with GPS tags remains among the highest program priorities to maintain monitoring efficiency.

Management

Lead in the environment remains the primary threat to condor recovery. Condors will continue to use public and private lands from PNP to the coast and beyond that offer excellent foraging, roosting, and nesting habitat. Addressing the threat of lead across these lands is an ongoing need, as is providing the best care possible to condors exposed to lead. A greater understanding of the efficacy of chelation treatment will help all condor release sites determine the conditions when it is most useful. Chelation treatment for condors should be further

researched and evaluated to increase the understanding of its effectiveness in relation to survival trends. NPS and VWS collaboration on chelation efficacy will help inform this evaluation and will continue through 2021.

Research

Each research project conducted to date has informed management decisions that affect the recovery of the species. PNP biologists continue to work closely with researchers and prioritize the collection of samples and data that support scientific research. With funding for research limited, condor recovery partners should continue to work together 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 create 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. Outreach efforts, considered paramount for condor recovery, are still limited by insufficient funding and therefore staff capacity.

In 2021, the ongoing uncertainties of the global pandemic will bring new challenges to non-lead outreach. The standard outreach methods of the past will need to be adapted to this new reality and novel approaches will have to be developed. Virtual and digital materials will play a larger role, and the development and publication of these materials will require new skillsets. PNP 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 successful outreach.

Recovery Planning and Multi-agency Coordination

Condor field team meetings (typically held annually and coordinated by USFWS) bring together a diversity of perspectives including 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 MSU-led PVA will help inform changes to management at release sites and direct well-informed decisions that are based on the best available science.

Appendix A – Public Interest Highlights

2020 marked the 18th year of the California Condor Recovery Program at Pinnacles National Park. Notable highlights and programmatic accomplishments include:

- In the aftermath of the Dolan Fire, our long-standing partnership with VWS to manage all condors in California allowed for rapid identification of priorities and sharing of essential tasks. Working together, we were able to quickly locate many condors and identify those that remained missing, evacuate a threatened nestling, and trap condors that had been burned but survived.
- With VWS staff, we quickly coordinated the successful evacuation of condor 1033 from a nest that was threatened by the Dolan Fire. PNP biologists employed their technical ropes rescue skills to access the nest and capture 1033. This rescue was highlighted by regional and national media outlets, providing an important and uplifting human and wildlife interest story during ongoing news of devastation by fire and a pandemic. It also demonstrated the incredible efforts taken by biologists to recover condors.
- Although the pandemic limited in-person non-lead outreach, early events showed a continuing positive trend among California hunters in use and satisfaction with non-lead ammunition. While ammunition availability was extremely low nationwide, the number of non-lead ammunition types developed and marketed increased this year.
- During the 2020 breeding season, two pairs of condors (692/726 and 700/678) attempted to nest in three previously undocumented nesting locations in the park. Although the three nest attempts failed, they highlighted the importance of PNP's famous rock formations as critical condor nesting habitat.
- One newly formed condor pair (606 and 747) successfully reared a young condor on private land outside of PNP independently of any direct management. Existence of the fledgling was confirmed when a photo of the condor family was sent to park staff by a local landowner. A great example of the community helping us monitor condors outside the park boundary.
- An established condor pair (236 and 340) successfully reared another condor, 1027, from a nest site they used three times previously. Similar to her siblings, 1027 fledged a month earlier than expected. Since fledging, she has been seen throughout the park, both with and without her parents, and interacting with other free-flying condors.

- Thanks to the efforts of the Oakland and LA Zoos, three PNP-managed condors with multiple metal fragments were successfully treated for lead toxicosis. They were all released back into the wild after concluding treatment.
- We received a captive-bred juvenile, 961 "Xanan", who was released at PNP at the end of 2020. The San Diego Zoo Safari Park is developing a photographic children's book about her life story, expanding outreach to a younger demographic.

Appendix B – Condor Mortality of Central California Condors, 2001-2020

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 J. Burnett, Big Sur Condor Program Coordinator and Senior Biologist.

Condor ID	Sex	Estimated Date of Death	Manager	Cause of Death
230	M	5/9/2001	VWS	Powerline Electrocution: Bird electrocuted on line (mid-span)
233	F	5/17/2002	VWS	Missing
212	F	10/30/2002	VWS	Powerline Electrocution: Bird electrocuted on line (mid-span)
254	M	2/19/2003	VWS	Powerline Electrocution: Bird electrocuted on line (mid-span)
260	M	5/20/2003	VWS	Malnutrition
170	M	6/15/2003	VWS	Lead Toxicosis
256	F	10/17/2003	VWS	Undetermined: Bird recovered in desiccated state
179	M	12/20/2003	VWS	Missing: Bird disappeared after wildfire at Hopper NWR
164	M	9/30/2005	VWS	Unknown: Bird recovered in desiccated state
376	M	6/30/2006	VWS	Powerline Electrocution: Bird electrocuted on line (mid-span)
363	M	7/14/2006	VWS	Malnutrition: Bird died from poor body condition
417	F	5/12/2007	PINN	Trauma to neck, possible predator
301	M	5/15/2007	VWS	Powerline Electrocution: Bird electrocuted on line (mid-span)
307	F	5/16/2007	PINN	Unknown - possible snake envenomation
356	F	10/2/2007	VWS	Unknown: found dead near release site in desiccated state
429	F	12/4/2007	VWS	Missing
278	M	6/25/2008	VWS	Missing - likely due to wildfire
377	F	6/25/2008	VWS	Missing - likely due to wildfire
336	F	9/7/2008	PINN	Lead Toxicosis
475	M	12/21/2008	VWS	Trauma
286	M	5/11/2009	VWS	Lead Toxicosis
503	F	7/6/2009	VWS	Trash Ingestion
422	F	7/12/2009	PINN	Unknown
303	F	10/23/2009	VWS	Lead Toxicosis
621	M	4/28/2011	VWS	Trauma, chick died in nest
624	U	5/25/2011	VWS	Trauma, chick died in nest
294	F	6/7/2011	VWS	Undetermined: bird recovered in desiccated state
499	F	11/9/2011	VWS	Aspiration
478	M	4/21/2012	PINN	Lead Toxicosis
588	M	7/21/2012	PINN	Unknown
298	F	10/22/2012	VWS	Lead Toxicosis
644	M	11/10/2012	VWS	Exposure: hypothermia.

318	M	11/30/2012	VWS	Lead Toxicosis
598	F	12/8/2012	PINN	Unknown
312	F	4/4/2013	PINN	Lead Toxicosis
681	U	4/13/2013	PINN	Unknown, chick - nothing in nest to recover, no necropsy report
715	U	5/20/2013	VWS	Unknown, chick disappeared soon after hatch
345	M	5/28/2013	PINN	Lead Toxicosis
335	M	6/1/2013	PINN	Lead Toxicosis
686	U	6/1/2013	VWS	Undetermined, chick recovered in desiccated state, died in nest
306	F	6/9/2013	PINN	Electrocution, possible indirect lead exposure
332	M	7/2/2013	PINN	Lead Toxicosis
194	F	7/11/2013	VWS	Missing
708	U	7/12/2013	VWS	Trauma, chick died in nest
313	M	8/6/2013	PINN	Lead Toxicosis
714	U	9/4/2013	VWS	Trauma, chick died in nest
693	U	9/8/2013	PINN	Unknown, chick - no collection based on remote nest location
501	F	9/25/2013	VWS	Missing
451	M	12/7/2013	PINN	Lead Toxicosis
739	U	4/28/2014	VWS	Unknown, chick disappeared before fledge
400	F	4/29/2014	PINN	Lead Toxicosis
401	M	6/15/2014	PINN	Lead Toxicosis (proximate) perforation of the ventriculus (immediate)
444	F	8/26/2014	VWS	Lead Toxicosis
411	M	12/6/2014	PINN	Undetermined: bird recovered in desiccated state
664	F	12/31/2014	VWS	Lead Toxicosis
753	M	4/16/2015	VWS	Missing (last detected 4/16/2015)
788	U	4/30/2015	VWS	Unknown, chick - nothing in nest to recover, no necropsy report
713	M	5/15/2015	PINN	Missing (last detected 5/15/2015)
782	F	5/23/2015	PINN	Unknown, chick - nothing in nest to recover, no necropsy report
798	U	6/10/2015	VWS	Unknown, chick - nothing in nest to recover, no necropsy report
242	M	7/30/2015	VWS	Lead Toxicosis
769	F	8/29/2015	VWS	Undetermined, suspected trauma
615	M	11/17/2015	VWS	Trauma - Predation
481	F	4/22/2016	PINN	Missing (last detected 4/21/2016)
742	F	5/1/2016	PINN	Septicemia
251	M	7/4/2016	VWS	Lead Toxicosis
838	U	12/1/2016	VWS	Trauma, fledgling euthanized due to injuries
514	M	3/17/2017	PINN	Anticoagulant toxicity
534	F	4/17/2017	PINN	Missing (last detected 4/16/2017)
583	F	6/28/2017	VWS	Missing (last detected 6/27/2017)
597	F	7/1/2017	VWS	Drowning
760	F	7/1/2017	VWS	Drowning
703	M	7/2/2017	VWS	Lead Toxicosis

460	F	7/7/2017	PINN	Egg binding
525	F	8/1/2017	PINN	Lead Toxicosis
787	F	12/24/2017	VWS	Drowning
614	F	1/19/2018	PINN	Lead Toxicosis
687	F	5/22/2018	PINN	Missing (last detected 5/21/2018)
706	M	6/11/2018	VWS	Lead Toxicosis
684	F	1/30/2019	PINN	Missing (last detected 1/29/2019)
991	U	4/4/2019	VWS	Unknown, chick - nothing in nest to recover, no necropsy report
351	M	4/27/2019	PINN	Electrocution
835	F	6/7/2019	PINN	Lead Toxicosis
744	F	6/22/2019	PINN	Lead Toxicosis
418	F	7/1/2019	PINN	Lead Toxicosis
795	F	10/8/2019	PINN	Lead Toxicosis
799	F	11/29/2019	VWS	Lead Toxicosis
842	F	12/22/2019	VWS	Lead Toxicosis
559	M	12/30/2019	VWS	Lead Toxicosis
463	M	1/5/2020	PINN	Lead Toxicosis
199	M	1/16/2020	VWS	Lead Toxicosis
222	F	1/22/2020	VWS	Missing
991	U	4/3/2020	VWS	Missing
405	M	4/25/2020	PINN	Lead Toxicosis
906	F	5/14/2020	VWS	Electrocution
231	F	5/21/2020	VWS	Missing
878	F	6/28/2020	PINN	Necropsy report pending
310	F	7/26/2020	PINN	Missing, but likely lead toxicosis
785	M	8/10/2020	PINN	Undetermined
448	M	8/21/2020	PINN	Missing since Dolan Fire, presumed dead
167	M	8/21/2020	VWS	Missing since Dolan Fire, presumed dead
375	F	8/21/2020	VWS	Missing since Dolan Fire, presumed dead
678	F	8/21/2020	VWS	Missing since Dolan Fire, presumed dead
773	M	8/21/2020	VWS	Missing since Dolan Fire, presumed dead
789	M	8/21/2020	VWS	Missing since Dolan Fire, presumed dead
875	F	8/21/2020	VWS	Missing since Dolan Fire, presumed dead
992	F	8/21/2020	VWS	Missing since Dolan Fire, presumed dead
1004	F	8/21/2020	VWS	Missing since Dolan Fire, presumed dead
1022	U	8/21/2020	VWS	Missing since Dolan Fire, presumed dead
1029	U	8/21/2020	VWS	Missing since Dolan Fire, presumed dead
874	F	8/28/2020	PINN	Lead Toxicosis
823	F	9/12/2020	VWS	Necropsy report pending - undergoing treatment for lead toxicosis at time of death
909	M	10/2/2020	PINN	Undetermined, only wings recovered
543	F	10/9/2020	PINN	Necropsy report pending
567	M	10/11/2020	VWS	Necropsy report pending - undergoing treatment for lead toxicosis at time of death
564	M	11/7/2020	PINN	Lead Toxicosis

Appendix C – Dolan Fire Impacts to California Condors



Contacts for correspondence:

Joe Burnett – Ventana Wildlife Society, Condor Program Lead Biologist,
joeburnett@ventanaws.org, (831) 800-7424

Alacia Welch – Pinnacles National Park, Acting Condor Program Manager,
alacia_welch@nps.gov, (831) 389-4486 x4255

Reporting Period: August 18, 2020- January 19, 2021

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Summary:

At the start of 2020, there were 101 California condors managed by Ventana Wildlife Society (VWS) and Pinnacles National Park (PNP) in central California. Following the Dolan Fire, the condor population declined by twelve birds. This was the single biggest loss of condors from a wildfire since releases began in California in 1992.

The Dolan Fire started on August 18 near Highway 1 along the Big Sur coast, a few miles south of the VWS Condor Sanctuary and burned nearly 125,000 acres through October 15, 2020 (98% containment). The Dolan Fire swept through the VWS Big Sur Condor Sanctuary on the night of August 20, including popular condor roost areas, and active nest sites in the vicinity. It destroyed VWS's Condor Release Pen and Research Facility, Figure 1.

Prior to the Dolan Fire there were eight pairs of condors nesting in central California, with five active nests in the coastal mountains of Big Sur (Figure 2) and three nests east of the Salinas Valley in the Gabilan mountains near Pinnacles National Park. From August 18-23, four condor nests near the VWS Condor Sanctuary in Big Sur were burned over and two were lost. As the fire advanced eastward in late August it began to threaten a fifth condor nest near Junipera Serra Peak. VWS and PNP biologists worked together to evacuate the condor nestling, # 1033, on September 2, before the fire reached the nest (Figure 3). Less than a week later, the Dolan

Fire rapidly pushed east and burned the area in which this nest was located. The other three nests east of the Salinas Valley were not impacted by the Dolan Fire.

On August 20, as the Dolan Fire approached from the south, VWS could no longer safely access the area and monitored two streaming video cameras located in the VWS Condor Sanctuary at their Condor Release Site. They spotted 27 different condors on the cameras throughout the day. Eleven of these condors, plus an additional one not seen on camera, wore satellite GPS transmitters that indicated they roosted overnight in the Sanctuary the night of August 20th. More than likely many of the others without GPS transmitters also roosted there. When the fire swept through that night, we suspect three with GPS transmitters perished (Figures 4 and 5). Since then, an additional seven free-flying condors and two nestlings went missing and are presumed dead, and one condor later died from burn injuries. In addition to normal radio-tracking efforts by both VWS and PNP teams working to locate all the missing condors, a pilot who professionally tracks animals using aerial telemetry also searched a large area. He flew over multiple popular condor areas in central California on three separate occasions and did not detect any of the missing birds.

In total, the Dolan Fire claimed the lives of 12 condors. Eleven of these condors were managed by VWS and one by PNP. All condors are identified by their 3 to 4-digit Studbook Identification numbers. Of the four adults, 167 and 448 were actively tending to nests at the time of the fire. The other two adults, 375 and 678, were of breeding age and paired with other condors, but not actively nesting at the time. Five sub-adult condors, 773, 789, 875, 992, and 1004 and two nestlings, 1022 and 1029, were also lost at the time of the fire, and sub-adult condor 901 died later from burn injuries sustained during the fire, Figure 6.

Condors Presumed Dead from Dolan Fire:

1. Condor 167 was a 23-year-old male that hatched in captivity on 5/6/1997. He was originally released into the wild in Big Sur by VWS on 12/12/1997. Wore one radio transmitter. Actively nesting with female 190, parent of nestling 1031.
2. Condor 375 was a 15-year-old female that hatched in captivity on 5/2/2005. She was originally released into the wild in Big Sur by VWS on 6/4/2006. Wore one radio and one satellite GPS transmitter. Paired with 330, not nesting in 2020.
3. Condor 448 was a 13-year-old male that hatched in captivity on 5/8/2007. He was originally released into the wild at PNP on 11/6/2008. Wore two radio transmitters and one satellite GPS transmitter. Actively nesting with female 543, parent of nestling 1022.
4. Condor 678 was a 7-year-old female that hatched in captivity on 3/9/2013. She was originally released into the wild in San Simeon by VWS on 11/10/2016. Wore one radio transmitter and one GSM-type GPS transmitter. Paired with 700, nested earlier in 2020, but not nesting at time of fire.

5. Condor 773 was a 5-year-old male that hatched in the wild in Big Sur on 3/22/2015. Wore one radio transmitter. Not yet breeding age.
6. Condor 789 was a 5-year-old male that hatched in the wild in Big Sur on 4/23/2015. Wore two radio transmitters. Not yet breeding age.
7. Condor 875 was a 3-year-old female that hatched in captivity on 4/29/2017. She was released into the wild in San Simeon by VWS on 12/7/2018. Wore one radio transmitter.
8. Condor 901 was a 3-year-old male hatched in the wild on 5/25/2017 and he wore one radio transmitter. Condor 901 did not perish immediately from the Dolan Fire, but succumbed later to injuries sustained during the fire. On 10/18/2020, PNP biologists captured 901 after they noticed he had severe burns to his beak, chest and legs (Figure 6) and transported him to LA Zoo for treatment. On 1/17/2021, 901 died from bacterial infections associated with his severe burn wounds.
9. Condor 992 was a 1.5-year-old female hatched in the wild in Big Sur on 4/18/2019. Wore one radio transmitter.
10. Condor 1004 was a 1.5-year-old female hatched in the wild near San Simeon on 7/10/2019. Wore one radio transmitter.
11. Condor 1022 was a 5-month-old nestling of unknown sex that hatched in the wild in Big Sur on 3/27/2020 to parents 448 and 543.
12. Condor 1029 was a 3.5-month-old nestling of unknown sex that hatched in Big Sur on 4/10/2020 to parents 567 and 311.

Date Recovered/GPS Location Data:

None of the missing condors have been recovered. There are three missing condors with satellite GPS transmitters - 375, 448, and 678. Condors 375 and 448 transmitted one last point each at 20:00 on 8/20/2020. The final location for 375 was WGS84 Lat/Long 36.16333, -121.62917 and for 448 was 36.16417, -121.62867 (see Figure 4). Condor 678 transmitted one last point on 8/18/2020, two days before the fire burned through the VWS Sanctuary. Condor 678 was observed at the Sanctuary via the condor cameras on 8/20/2020, so we presume this condor perished in the fire as well (see Figure 5). Condor 678's GPS transmitter used GSM technology (cellular signal) to upload location data and we assume she did not get in range of a cellular tower between her last GPS point on the 18th and when the fire arrived on the night of the 20th. This delay is common for GPS transmitters using GSM technology. Condors 375 and 448's GPS transmitters are more consistent because they each use a satellite (Argos) connection to upload location data each day.

Additional Condors Impacted/Injured by Dolan Fire:

1. Condor 543 was an 11-year-old female that hatched in captivity on 5/29/2009. She was actively nesting with 448, parent of nestling 1022. She was found dead on 10/10/2020

and there was evidence of healing burns on her legs/feet and possibly head/neck. It is unknown at this time if the burns contributed to her death.

2. Condor 567 was a 10-year-old male that hatched in the wild in Big Sur on 4/25/2010. He was actively nesting with female 311, parent of nestling 1029. He suffered burns to head/neck, feet, and breast area, Figure 7. He was captured in the wild on 10/1/2020 suffering from acute lead toxicosis and died on 10/10/2020 in captivity. It is unknown at this time if the burns contributed to his death.
3. Condor 711 is a 7-year-old male that hatched in captivity on 5/20/2013. He was released into the wild in San Simeon by VWS on 10/14/2015. He was seen with healing burns on his head/neck, Figure 8.
4. Condor 1031 is a 6-month-old nestling (unknown sex) that hatched on 4/25/2020 in Los Padres National Forest to parents 167 and 190. Male 167 was lost in the fire and female 190 survived and continued to care for 1031. However, condor 1031 suffered a leg injury when she fledged from the nest and was evacuated on 10/19/2020 (Figure 9) and taken to LA Zoo for treatment.
5. Condor 1033 is a 6-month-old female nestling that hatched on 4/6/2020 in Los Padres National Forest to parents 219 and 231. She was evacuated from the nest before the fire burned through and reared in captivity, Figure 3.



FIGURE 1. VWS Condor Release Pen (left) and Research Facility (right) destroyed by the fire. Photos by VWS.

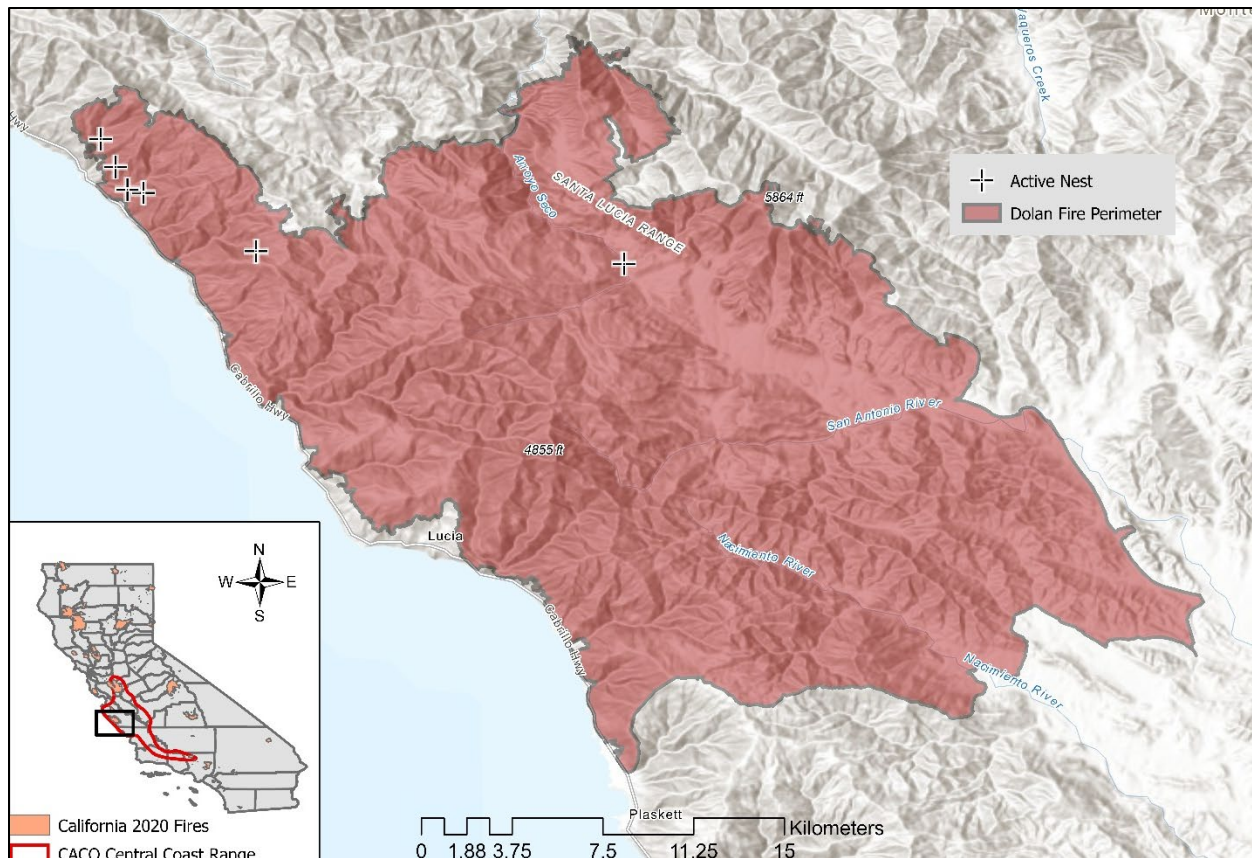


FIGURE 2. Condor nest locations (+) within the Dolan Fire perimeter (Outlined and shaded in red). Map by VWS.



FIGURE 3. Evacuation of condor nestling 1033 due to approaching wildfire. NPS Photos.

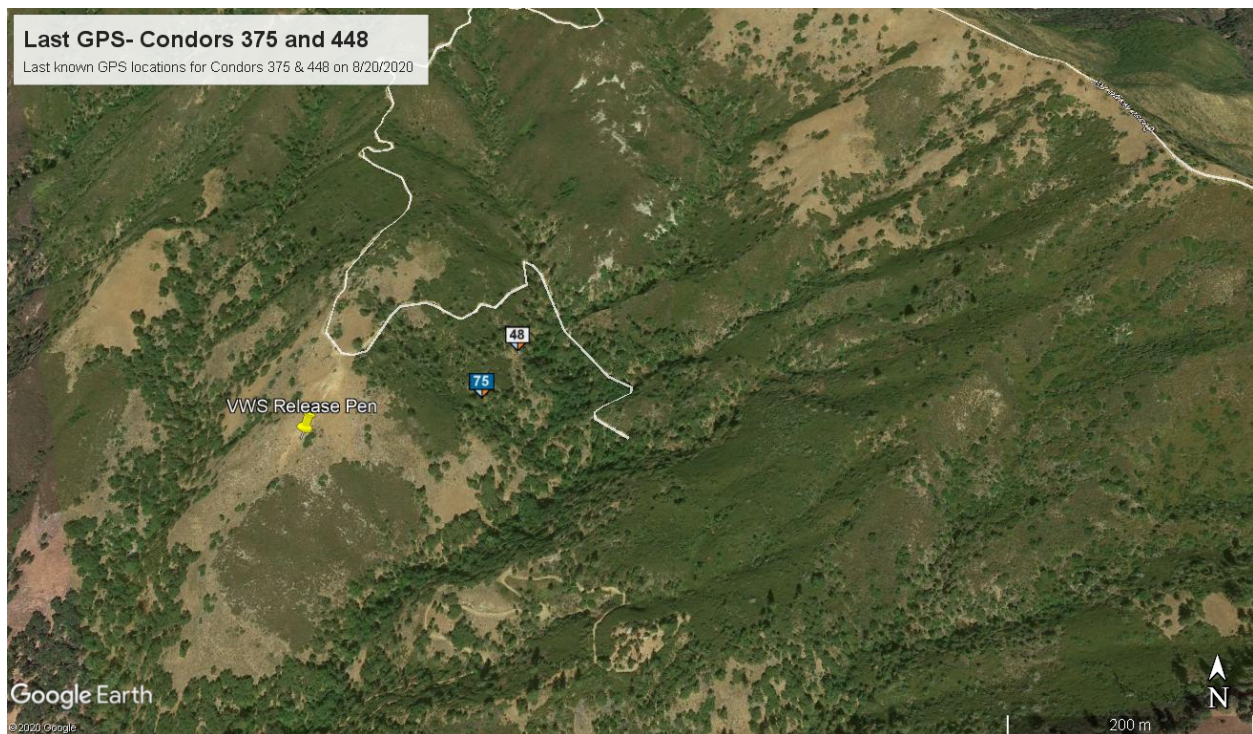


FIGURE 4. Last GPS locations transmitted for Condors 375 and 448 on 8/20/2020. Map by VWS.

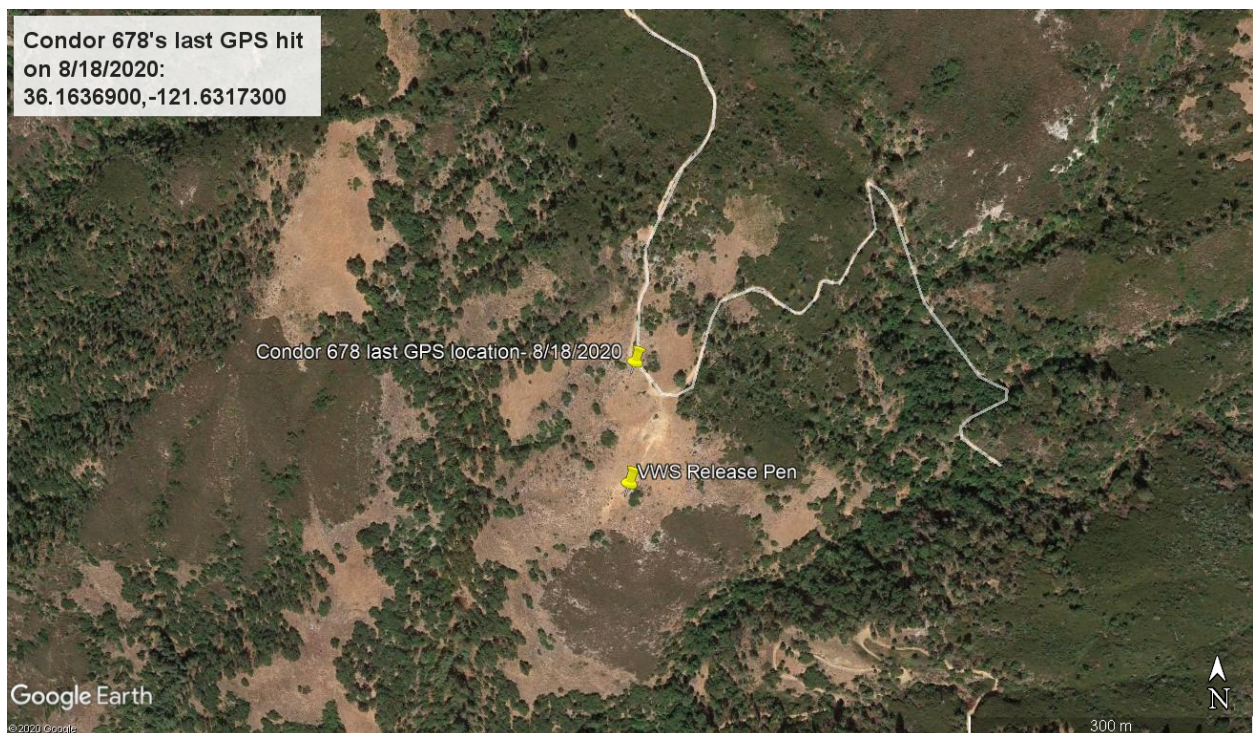


FIGURE 5. Last GPS Location for Condor 678 on 8/18/2020. Map by VWS.



FIGURE 6. Condor 901 burn injuries to beak (left) and legs/feet (right). Photos PNP and LA Zoo



FIGURE 7. Condor 567's burn injuries to (left to right) head/neck, breast, and feet. VWS photo-S. Herrera



FIGURE 8. Condor 711 burn injuries to neck and head. VWS photo- S. Herrera



FIGURE 9. VWS Biologists evacuate Condor 1031 in Big Sur, CA., on 10/19/2020. VWS photo- S. Herrera

Appendix D – Scientific Publications with PNP Co-authorships

Bakker, V.J., Smith, D.R., Copeland, H., Brandt, J., Wolstenholme, R., Burnett, J.,...Kirkland, S. (2016). Effects of Lead Exposure, Flock Behavior, and Management Actions on the Survival of California Condors (*Gymnogyps californianus*). *EcoHealth*.

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