

Pinnacles National Park California Condor Reestablishment Program Annual Report 2019



Pinnacles National Park Report
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A handwritten signature in black ink, appearing to read 'Alacia Welch', with a long, sweeping horizontal line extending from the end of the name.

Alacia Welch, Acting Condor Program Manager

Cover photo: *Condor 996, the only condor fledgling from a nest in Pinnacles National Park in 2019, perches in a tree shortly after fledging. NPS Photo by Gavin Emmons.*

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Volunteers

Joseph Belli, Mike Baird, Darryl Zimmerman, Bob Quaid, Sean and Sarah Parnell, Barbara Lutes, Jeff Robinson, Marisa Dobkins, Katie Fitzgerald, Kira Gunderson, Rakesh Agarwal, Tia Alexander, Ben Sims, Richard Neidhardt, Susan Emmons, and Megan Gnekow.

Interns

Maddi Burns, Danaé Mouton, Jack Obergfell, and Allison Rogers.

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 101 condors in central California. During 2019, PNP monitored all birds using 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 Big Sur, CA. This report focuses on Pinnacles Condor Program management of birds released from the park but also includes some VWS-managed condor data, courtesy of VWS.

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, Photo 1. Argos satellite GPS data are downloaded daily from Woods Hole Group and mapped in ESRI ArcGIS version 10.3. PNP also deploys GSM (cellular technology) GPS tags manufactured by Microwave Telemetry (MT). Data from MT GSM tags are received via email when a tagged condor flies within range of a cellular tower. In addition, 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.



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

Radio tracking within and around PNP is conducted five to seven days per week. Biologists use high points to increase probability of hearing a signal. 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) 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. PNP follows US Fish and Wildlife Service (USFWS) condor carcass collection procedures. All field data is recorded in Access databases. Additionally, summary data from 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 2019 to measure condor blood lead levels, perform transmitter maintenance, and take 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 co-workers who are already listed on PNP's USFWS recovery permit as approved handlers. Personal protective equipment (PPE) during handling includes eye protection, long-sleeved shirts and pants, closed-toe boots, and leather and nitrile gloves, Photo 2.



*Photo 2, Crew members handling a condor.
NPS Photo by Kaitlin Lopez.*

Nest monitoring

PNP and VWS manage nests based on geographic location and ease of monitoring as opposed to who manages the adult condors.

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-nesting 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. As in 2017 and 2018, PNP aimed to conduct an egg fertility check and two nestling checks per accessible nest.

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 weighed, measured, and left in the nest. If an egg is not fertile, it is removed from the nest 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 nesting 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

Photo 3, Rose Fielding collecting nest trash. NPS Photo by Gavin Emmons.

monitored more closely. Biologists search and/or sift nest sites for eggshell fragments and trash, which are removed when found, Photo 3. 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 few hundred feet 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 monitoring software. This software records multiple days of video so it can be reviewed 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 use “clean” food supplies acquired from organic dairies and place carcasses approximately twice per week at one or two established bait stations in the park. Other carcasses may also be placed after they are radiographed to ensure there are no foreign or

metallic objects in the carcass, such as spent ammunition. Bait stations include the captive pen and 'Hilltop' semi-permanent bait site, both located in areas in the park that are closed to the public. Safety protocols during baiting 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 any 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 observe condor interactions, feeding patterns, and behaviors. Memory cards from motion-sensitive 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 locate condors that do not have functioning GPS or vhf tags.

Non-proffered Food

Non-proffered food is any carcass that PNP or VWS biologists have not placed for condors at a bait site. When condors are observed feeding on non-proffered food, biologists identify the carcass species when possible. Observing condors feeding on private land from public roads limits biologists' ability 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 one of four captive breeding centers: Los Angeles Zoo, San Diego Zoo, Oregon Zoo, and the Peregrine Fund's World Center for Birds of Prey. Typically, PNP receives these birds sometime in the early fall when the condors are about a year and a half old. Depending on where the juvenile condors are coming from, they may be driven to the park or flown to a nearby airport by volunteer LightHawk pilots. When the captive-reared young condors first arrive at PNP from the breeding centers, they spend at least 60 days in the pen prior to their release to the wild. They are "soft released", which means they are not caught up 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 that is out of view behind a wall and one-way glass closes that door behind them and then opens the outer door to release the bird. This soft release method helps the condors move into the wild with the least amount of stress. Releasing these young condors is vital for bolstering the wild population, since condor nests in the wild are not outpacing deaths.

Monitoring Captive Birds

Captive condors are held at PNP's captive pen, Photo 4, as needed for flock management. An electrified power pole at the pen delivers negative reinforcement to discourage them from

landing on or near power poles when they are in the wild. During handling and prior to initial release of young juveniles, biologists monitor condor health and interactions at the captive pen.



Photo 4, PNP captive pen with six captive condors perched inside and one free-flying condor perched on top. NPS Photo by Gavin Emmons.

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.

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 microtrash consumption, West Nile Virus, electrocution from perching on power poles or flying into power lines, and direct human interactions. PNP biologists conduct management with established protocols to study and reduce the impacts of these risks.

Lead exposure treatment

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 collect immediate results that determine whether a condor requires treatment for high blood lead levels, Photo 5. The lead treatment protocol for PNP-managed condors remained the same as previous years, where the threshold used to initiate chelation treatment is a blood lead value of 35 µg/dL or greater. Condors with elevated blood lead levels on a LeadCare II Analyzer are radiographed in the park's Condor Care Unit (CCU), at zoos, or clinics to help inform treatment needs. Radiographs taken at PNP may be emailed to veterinarians for their review after being taken. Birds with possible metallic densities in their gastrointestinal tracts, or those with blood lead levels >65 µg/dL, are transported to the Oakland or LA Zoos for treatment. Condors with clear radiographs and blood lead levels between 35-65 µg/dL may be treated at PNP when there is sufficient staff capacity to care for birds daily. In addition, condors with clear radiographs and blood lead levels between 25 and 35 µg/dL may be monitored in the captive pen for two weeks at PNP for a lead depuration study.



Photo 5, *Kris Dudus using LeadCare II Analyzer.*
NPS Photo by Rose Fielding.

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 but are shipped to a lab for analysis. PNP staff worked with NPS Biological Resources Division (BRD) staff to modify 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.

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 permitted 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 2019, 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 injections 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 staying near humans or 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.

Collaborative Research

In 2019, 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. The new research projects implemented in 2019 (MSU) is described later in this report.

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 benefit 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 ammunition to scavenging wildlife, Photo 6. PNP has dedicated half the time of one biologist to conduct outreach and work closely with the Institute for Wildlife Studies (IWS), WWS, The Peregrine Fund, Oregon Zoo, and other partners to collaborate on outreach efforts. Additionally, during routine fieldwork, the staff speaks 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.



Photo 6. An example of the booth set up at typical outreach events. NPS photo by Daniel Ryan.

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 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. With hunting and ranching audiences, available alternatives to lead ammunition are discussed, as well as how to achieve the best performance from non-lead ammunition. With land management agency staff, we discuss the benefits of reducing wildlife lead exposure from external and internal actions, and how to change internal practices. With park visitors and the general public, staff stresses the need for continued hunting and ranching, as well as how those traditions play an important role in wildlife conservation.

Personnel

Implementing a long-term endangered species recovery program requires consistent staff capacity with highly trained, experienced biologists. Our program has been 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. PINN's invasive animal biologist also works throughout the year part-time on wildlife health issues and 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 management of the species. In 2019, 13 volunteers contributed a total of 1994 hours. Additionally, 4 interns contributed 3223 hours.

RESULTS

Population Monitoring

In January 2019, PNP managed 40 condors, which made up about 40% of the flock in central California. There were five deaths in 2019 and no captive-reared birds were released. There were 14 nesting attempts in central California, with 11 of those including at least one PNP condor. Six nests successfully fledged chicks. Two new fledglings were managed by PNP and four by VWS. The total number of PNP-managed condors at the end of 2019 was 37. The sex ratio is skewed toward males with 14 females, 22 males and one unknown.

Combined with condors managed by VWS, 101 birds occupied the central California area at the end of the year, Figure 1.

1997-2019 Wild-fledged Condors and Captive-reared Releases in Central CA Population, including Deaths Per Year

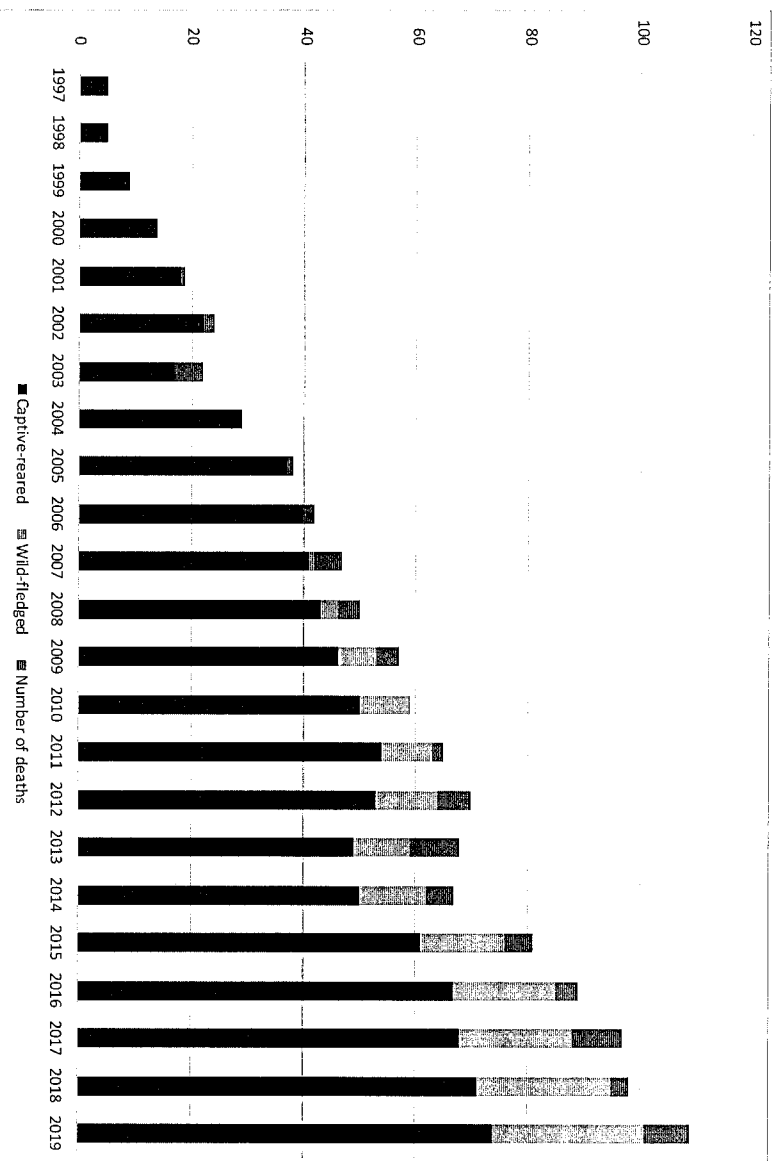


Figure 1, *Summary of wild-fledged condors, captive-reared releases, and annual number of deaths in central California. Chart presents total number of condors in the wild (both wild-fledged and captive-reared) currently managed by PNP and VWS in the central California area, in addition to the number of condor deaths each year. Note that condor nesting deaths are not included in this chart. VWS data provided by J. Burnett, Big Sur Condor Program Coordinator and Senior Biologist.*

As of December 2019, the ratio of adult males to females was weighted toward males, with 61% of the central California population male and 39% female. Adults are those hatched in 2014 or earlier. There were five juveniles of unknown sex at the end of 2019, 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 very similar to the adults, 62% male, 38% female. A couple of explanations for the ratio include the facts that over the years more females died than males (41 females, 33 males and one unknown) and, broadly speaking, there are more males available for release from the captive breeding program into central California each year. This skewed sex ratio is a concern because it may already be impacting nesting attempts. If it is an indicator of adult females having higher mortality than males, that will have strong population growth (or demographic) implications in the short and long term.

Survival Monitoring

Throughout the year, PNP monitored radio and GPS-tagged condors almost daily. Condors without functioning tags were observed opportunistically. This year, there were 5,477 visual observations of wild condors by PNP biologists in the field and 5,589 observations seen on remote video and still cameras. Additionally, there were 863 observations of captive condors. Whenever possible, biologists closely monitored any condor behaving abnormally and any bird with a GPS tag that did not move in over 24 hours to determine if the individual was injured or sick.

Staff used GPS data to locate approximately 90% 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 tags on 36 PNP-managed condors throughout the year. Condors released by both VWS and PNP use the landscape in all directions surrounding the park. Figure 2 maps a selection of satellite GPS location data from several PNP-managed condors and represents the core range used by condors in central California in 2019. Because condors are social, monitoring them via GPS tags adds great efficiency to locating all released condors, including those without functioning radio transmitters or GPS tags.

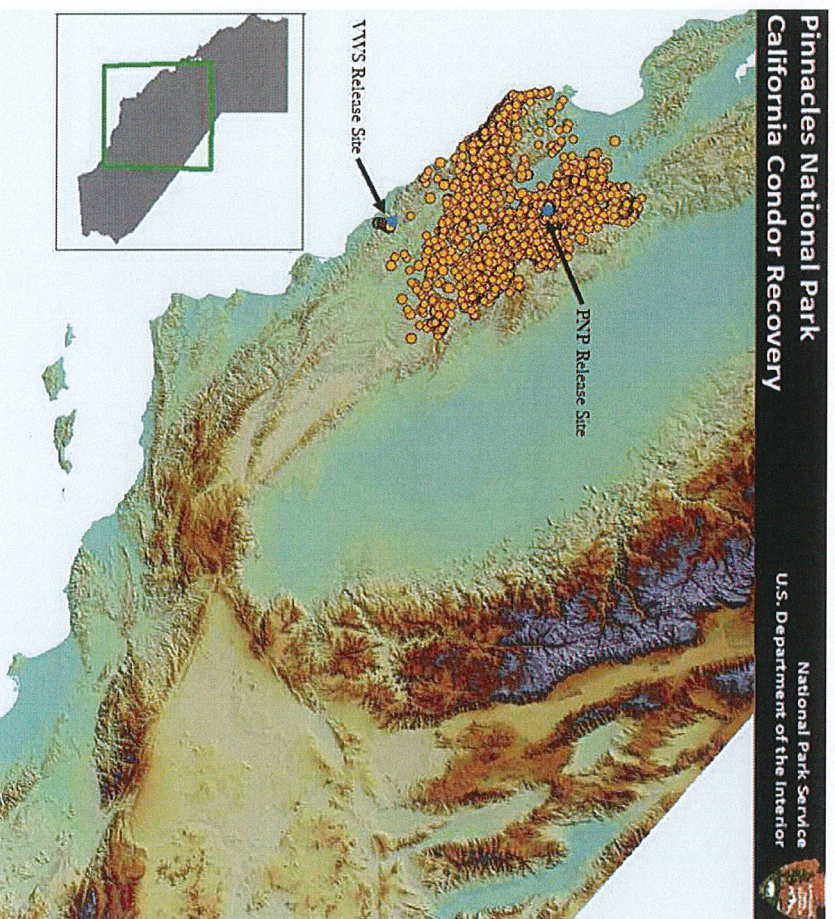


Figure 2, Typical range of PNP-managed condors in 2019.

Long Range Movements

In 2019, condor 785 took a long-range flight during April and May, Figure 3. He went from Pinnacles to the Big Sur coast, down to the southern California condor release site, and then up into the Sierra Nevada range outside of Kings Canyon National Park. The flight distance was approximately 670 miles.

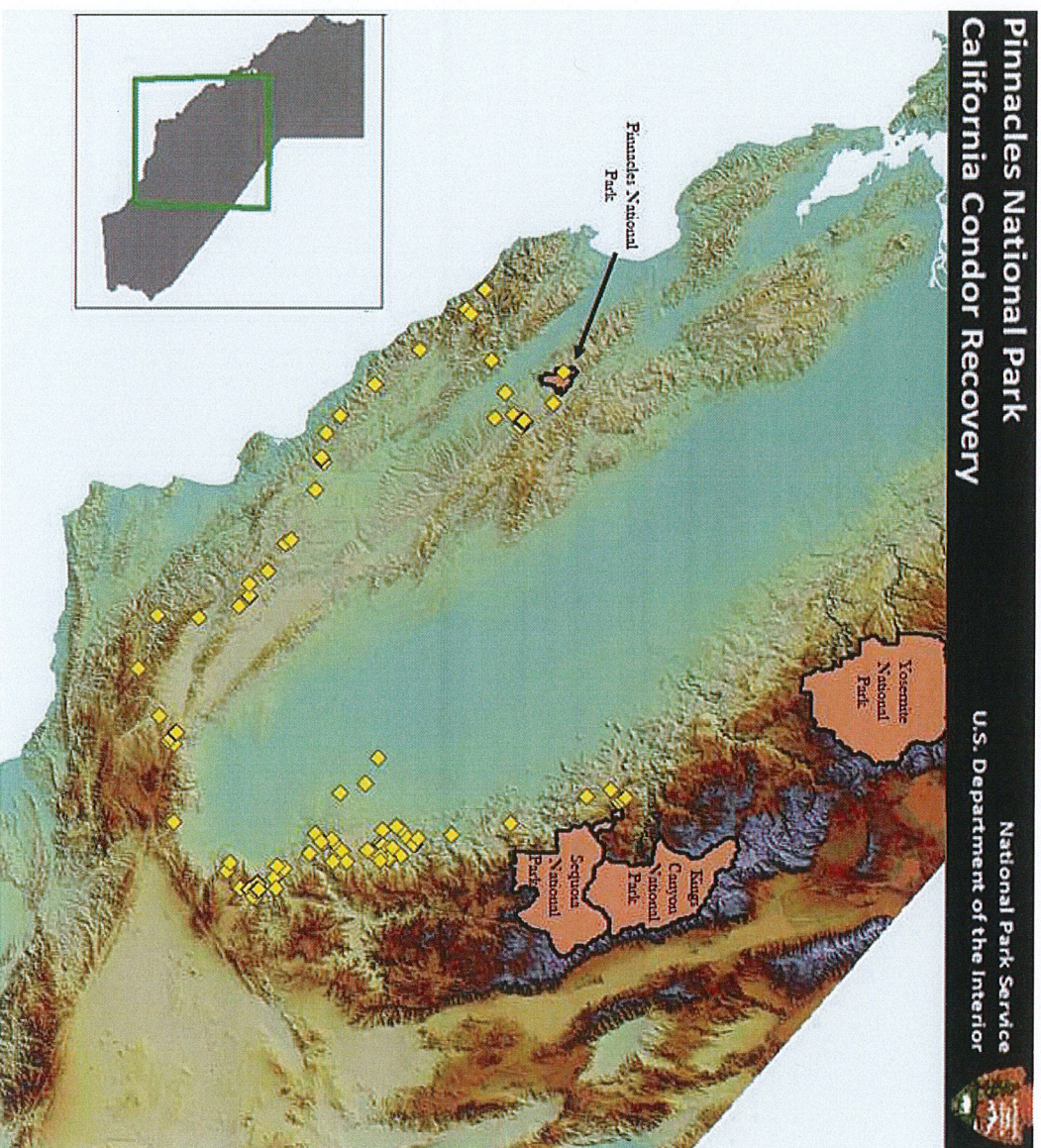


Figure 3, Flight map of condor 785 over a two-month period.

Mortality

This year five condor carcasses were collected (Photo 7), bringing the total loss for PNP-managed condors to 31 birds since the beginning of the program in 2003, Appendix A. Condor 351 died on approximately 4/27/19, and the cause of death was determined to be electrocution. Condors 835 and 744 died in June, condor 418 in July, and condor 795 in October. All four of those condors died from lead toxicosis.

Missing Birds

One PNP condor, 684, has been missing since 1/29/2019.

Trapping

PNP had two focused trapping seasons in 2019, January-February and September-December. Trapping conducted by VWS allowed for a greater number of condor captures. In total, 33 PNP-managed condors were trapped in 2019 at both PNP and VWS facilities combined (not including condors handled in nests). Twenty-two condors were trapped twice, and two condors were trapped three times this year. In 2019, PNP staff spent 171 person-days trapping and captured 50 condors, Table 1.



Photo 7, Kris Dudus removes the transmitters from deceased condor 744. NPS photo by Rose Fielding.

Table 1. *2019 trapping effort and captures of PNP and VWS-managed condors at PNP captive pen.*

Date Range	Total handling days ^a	Total captures ^b	Total individuals captured ^c	Person Days ^d
January - February	9	41	40	41
September - December	12	41	41	71
Opportunistic Year Round	6	14	14	59
Totals	27	96	50	171

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

^bNumber of condors trapped including multiple captures of the same individual during the given time frame.

^cNumber of individual condors trapped during the given time frame 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.

Reproduction

For the first time since the Condor Recovery Program began at PNP, there was more than one nest within the boundary of the park in the same season. Two pairs and one trio each nested within the park. Two of the nests failed before each egg hatched, but it demonstrated that multiple pairs of condors can nest within the PNP boundary, which encompasses approximately 27,000 acres.

In 2019, there were 11 nesting pairs or trios in central California, Table 2. One of the pairs and two of the trios double-clutched after their first egg failed. Eleven PNP-managed condors were involved in nest attempts. This year, PNP managed four of the nesting pairs/trios in central California. Two nests failed while there was an egg in the nest. One pair had a successful nest. The fourth pair had an initial nest failure but laid a second egg that later fledged. Later blood testing of this offspring revealed that the sire was not the male of the pair. In all, there were six fledglings in 2019, although one (991) remains unconfirmed visually.

Table 2, 2019 central California nesting summary. VWS data provided by J. Burnett, Big Sur Condor Program Coordinator and Senior Biologist.

Nest ID	Nesting Male	Nesting Female	Wild Egg ID	Estimated Lay Date	# of Nest Entries	Wild Egg Fate	Foster Egg Used	Foster Egg ID	Nesting Studbook	Nest Outcome
NC-7	589	569	CC119	01/30/19	0	Failed before hatch	No	NA	NA	Fail
HS-2	448	418	CC319	02/04/19	0	Hatched in nest	No	NA	991	Fledge
BF	199	438	CC319	02/14/19	0	Failed before hatch	No	NA	NA	Fail
BCS	574	538	CC419	02/19/19	0	Hatched in nest	No	NA	992	Fledge
To	204/470	646	CC519	02/20/19	0	Failed before hatch	No	NA	NA	Fail
BCN-2	559	543	CC619	02/23/19	0	Failed before hatch	No	NA	NA	Fail
HP-5	463/692	726	CC719	02/20/19	0	Failed before hatch	No	NA	NA	Fail
NMW-2	351	222	CC819	02/22/19	0	Failed before hatch	No	NA	NA	Fail
MAC-5	340	236	CC919	03/13/19	0	Failed before hatch	No	NA	NA	Fail
NC-7	589	569	CC1019	03/26/19	4	Hatched in nest	No	NA	996	Fledge
AI	566/711	725	CC1119	03/17/19	0	Failed before hatch	No	NA	NA	Fail
Gr	204/470	646	CC1219	05/04/19	0	Hatched in nest	No	NA	1003	Fledge
RB2	566/711	725	CC1319	05/13/19	0	Hatched in nest	No	NA	1004	Fledge
SB2	330	375	CC1419	02/16/19	0	Hatched in nest	No	NA	1006	Fledge

** 606 is the actual sire of 996; nestling raised exclusively by 589/569.

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 micro-trash if found within nest cavities. Nesting results should be interpreted with this in mind. In addition, each year a greater number of condors in the central California flock reaches breeding age, which should increase the number of nesting attempts over time, Figure 4. In 2019, biologists entered one of the PNP-managed nests, Photo 8. During the first entry, the nestling was heavily infested with blood sucking parasites that were later identified to be a type of swallow bug. The veterinarian administered a dose of Ivermectin, and staff entered the

nest a second time to determine if the medication had been effective. No parasites were found, and the nestling was given a second dose of Ivermectin to complete the course of treatment.

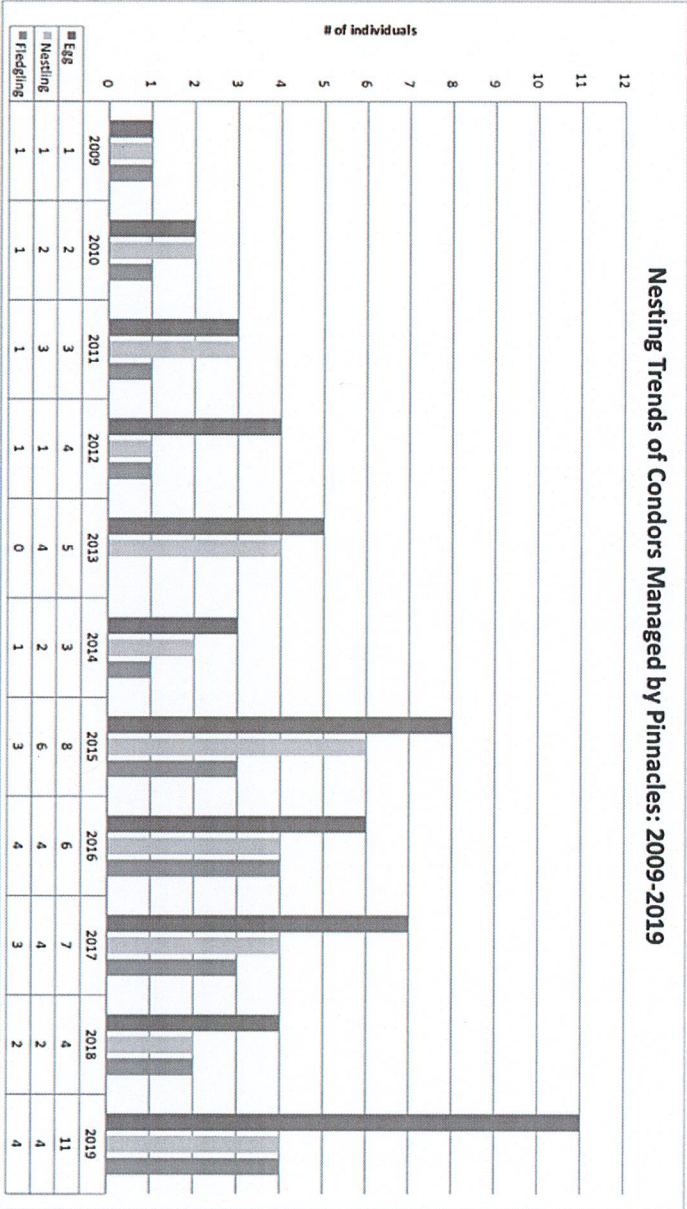


Figure 4, Nesting trends of condors managed by Pinnacles: 2009-2019. Eggs, nestlings, and fledglings for PNP-managed condors. *Note: these data include nests that had a PNP-managed breeder, but the nestlings were not necessarily PNP-managed.*

Of the six successful central California nests in 2019, PNP managed two: one in the park and one on public land in San Benito County.

PNP used a remote video camera to monitor a nest again this year and captured never before seen behavior. The camera was in a previously used nest and was active prior to egg laying. It captured the entire breeding season. The pair that used the nest in 2017 was recorded going into the site beginning in October 2018. By December 2018 they were seen together in the nest for an hour or more at least once a week. About one month after the female laid

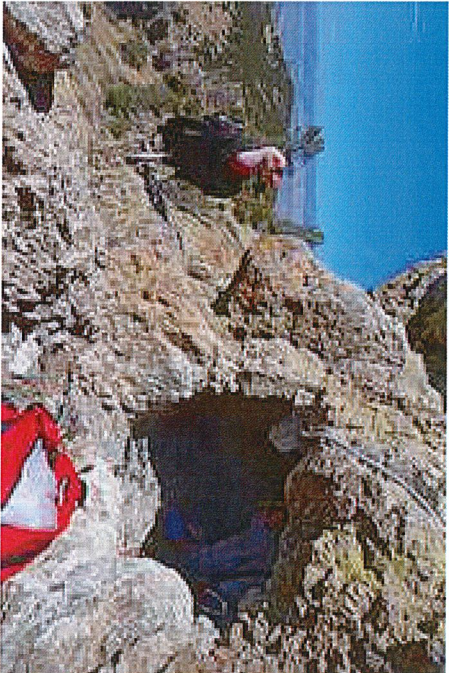


Photo 8, Rose Fielding in a nest in the park. NPS photo by Gavin Emmons.

an egg, a male that was not her mate was seen in the nest, displaying to her. The egg was not seen again, and staff presume he had pushed the egg out. A condor interfering with a nest in this way had never been recorded. Over the following few weeks, the extra male continued to display and attempted to copulate with the female. Ultimately, the nest camera capture video of the extra male and original male fighting. Afterwards, the extra male was not seen at the nest site again for the remainder of the breeding season and the female laid a second egg, which successfully hatched and fledged. This nest exemplifies the important information that can be gained from a nest video camera. Many condor nests fail during the egg stage and we rarely observe the reason why, but with nest video cameras, we can begin to understand the causes for nest failures.

Microtrash

The nest in PNP in 2019 contained 49 pieces of hard plastic, one metal bottle cap, and three pieces of large tape-like plastic, which staff removed during four nest entries. In all, trash removed from nests over the years included bottle caps and items made of plastic, rubber, cloth, and metal; and items weighed between .07 and 26.9 grams.

Baiting

In 2019, biologists placed 216 calves procured from organic dairies near Modesto, CA to bait the captive pen during trapping, to feed captive condors and to attract condors to a video monitored hilltop. During trapping seasons, carcasses were placed exclusively at the pen to increase trapping success.

Remote Monitoring

To supplement radio and GPS monitoring, tens of thousands of remote motion-triggered photos were collected and reviewed regularly throughout the year. Additionally, thousands of hours of video were recorded and reviewed by PNP biologists.

Non-proffered Food

This year, biologists and members of the public reported observations of six non-proffered feeding events that resulted in 74 observations of condors feeding on carcasses other than those provided at the PNP or VWS bait sites. Many feeding events in the wild go unrecorded due to limited access to private land.

Management

Captive-bred Releases

Two captive bred condors (both males) arrived from the Oregon Zoo via LightHawk volunteer pilots in September 2019. Additionally, a captive-bred male condor arrived from the LA Zoo.

Due to weather and staffing limitations, captive condors were not released in 2019 but planned for release in early 2020.

Lead Sampling

Blood lead level sampling continued to be a priority for any PNP-managed condor, whether captured during a scheduled trapping season or opportunistically. Figure 5 summarizes the lab blood lead values for all PNP condors since 2007. In 2019, a total of 34 PNP-managed condors were tested. Birds with levels <35 µg/dL on a field lead tester did not receive chelation treatment. Note that lab values are often greater than field values.

Treatment

Chelation

In 2019, six condors required chelation treatment. Two condors were treated at PNP, three at the Oakland Zoo, one at the LA Zoo, and one at both the Oakland Zoo and LA Zoo. Figure 5 includes the number of PNP condors that received chelation treatment following capture since 2007.

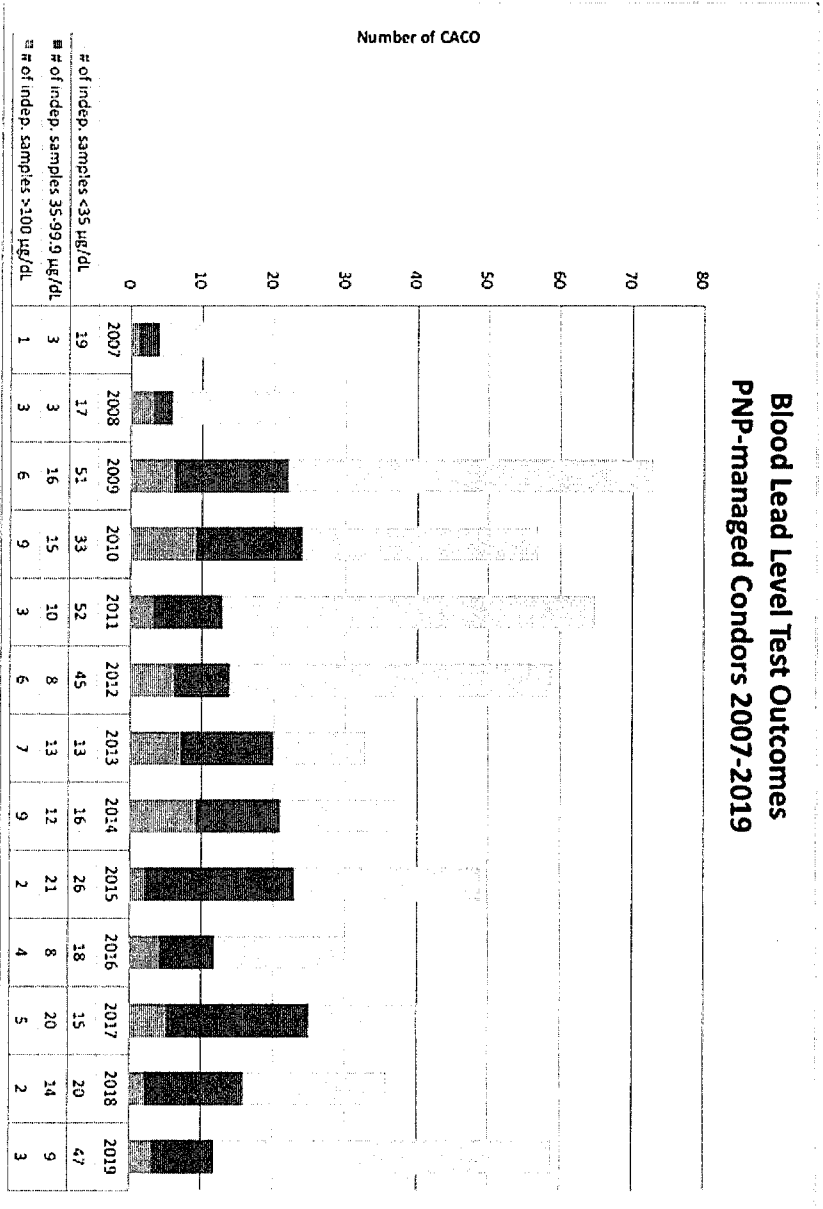


Figure 5. Blood level lab test outcomes in µg/dL and number chelated for PNP-managed condors: 2007-2019.

Radiographs

Condors with blood lead levels >35 µg/dL based on the result from a LeadCare or Lead Care II Analyzer were radiographed to determine whether metallic densities were present. All condors taken to Oakland or LA Zoos for chelation treatment were radiographed by veterinary staff on site, Table 3.

Table 3. *Radiograph information for PNP-managed condors in 2019.*

Condor	Location	Date	Purpose	Metallic Density	Outcome	Chelated
564	Oakland Zoo	2/7/2019	Lead Exposure	No		Yes
564	Oakland Zoo	2/22/2019	Swollen Foot	No	No breaks or abnormalities in legs/feet	NA
418	Pinnacles	5/31/2019	Lead Exposure	No		Yes
550	Oakland Zoo	11/7/2019	Lead Exposure	No		Yes
874	Pinnacles	11/14/2019	Lead Exposure	No		Yes
688	Oakland Zoo	12/8/2019	Lead Exposure	Yes	One fragment in GI tract	Yes
688	Oakland Zoo	12/15/2019	Lead Exposure	Yes	Fragment in crop	Yes
688	Oakland Zoo	12/19/2019	Lead Exposure	Yes	Fragment in proventriculus	Yes
688	Oakland Zoo	12/21/2019	Lead Exposure	Yes	Fragment in ventriculus	Yes
688	LA Zoo	12/24/2019	Lead Exposure	Yes	Metallic density in intestines	Yes
688	LA Zoo	12/29/2019	Lead Exposure	Yes	Metallic density present	Yes
463	LA Zoo	12/31/2019	Lead Exposure	Yes	2 metallic densities in ventriculus	Yes

Note: table includes PNP birds radiographed either at PNP or elsewhere and any VWS birds that were radiographed at PNP.

Surgeries

In 2019, two PNP-managed condors underwent patagial hole repair surgery.

Vaccination

In 2019, West Nile Virus vaccinations were given to 30 PNP condors.

Hazing

In 2019, staff hazed seven condors from locations that were unsafe or too close to people.

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 Research

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. This research results will be published in a peer-reviewed journal in the coming year. 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 Research

PNP and VWS, in collaboration with Montana State University 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 showing 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.

Population Viability Analysis (PVA)

Montana State University (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 the San Diego Zoo. Initial results with data through 2013 were published in 2016 by Bakker, et al (see Appendix C). The project continues to add all relevant data from 2019-2020 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 Research

San Francisco State University (SFSU) researchers in collaboration with USFWS, VWS, and PNP, analyzed blood samples for parasites that can be associated with diseases, such as avian malaria. This study involved 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 is expected soon.

Rodenticide Exposure Research

Preliminary results from condor liver samples analyzed in recent years showed 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 will continue through 2020.

In addition, Redwood National Park (REDW) and PNP are collaborating with Integral Ecology Research Center to conduct spatial modeling of central and northern California to map areas of high risk for illegal marijuana grow sites and their related toxins, particularly rodenticides. This work began in 2018 and was completed in 2019, and a final report due to NPS in 2020.

Condor Range and Movements Research

In 2019 PNP's research collaboration with Colorado State University continued. Researchers are analyzing condor behavior, environmental parameters, and GPS data to predict long term movements into 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. This project will be completed in summer 2020.

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 consciousness and enthusiasm and is one of the duties 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, the efforts have continued. NPS staff from Sequoia & Kings Canyon, Grand Canyon, and Pinnacles National Parks have been creating an NPS-wide condor subject website that is set to launch in 2020. This site will be a source of accurate and consistent information about condors and will include tips for seeing condors in all of the various national park units that were a part of 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. This year condor staff and volunteers spoke with 4,033 park visitors within the park and 53 individuals while tracking outside of the park boundary.

In addition to informal contacts, three biologists presented at the NPS Inventory and Monitoring Science Symposium. Biologists also led a condor education activity at Camp

Pinnacles, a camp at the park for local elementary schools, and interfaced with approximately 400 children.

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 efforts 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 from the inadvertent ingestion of spent ammunition in animal remains left in the field. In 2019, PNP had hired a biologist into the vacant non-lead outreach position, with half his time dedicated to non-lead outreach. This position has reinvigorated the efforts that slowed in 2018 during staff turnover; and built upon momentum that PNP had captured with partners working in non-lead outreach in past years.

PNP is committed to its 14-year effort (with many partners) to help hunters and ranchers switch to non-lead options through education and positive relationship building. Great progress has been made in this area and although much work exists, there are positive trends in acceptance and use of non-lead ammunition over time. Ammunition availability increased as well, with every major ammunition manufacturer offering at least one non-lead option.

2019 saw the full implementation of CA Assembly Bill 711, signed into law 2013 and in full effect this July. This regulation requires non-lead ammunition for the take of all wildlife species for any reason in the state of California. Without an official state outreach effort focused on the performance, ballistics, properties, or use of non-lead ammunition many hunters and ranchers were unprepared about the switch to a new tool they were unfamiliar and inexperienced with. The public outreach efforts PNP and IWS developed this year aimed to fill that educational need and address the specific issues raised by new users. Outreach events such as hunting expositions, hunting club meetings, shooting demos, and ranchers' workshops reached over 6,000 individuals directly in CA. In addition, broad targeted outreach through radio, newspaper, blog and podcast interviews reached an even larger audience in and out of the state.

Recognizing that the NPS and other land management agencies also can 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 has been expanded this year. Trainings and workshops for biologists as well as law enforcement (who frequently are tasked with injured animal dispatch) were conducted across the country

for the National Park Service at several significant Regional workshops. These presentations reached NPS natural resource management staff and aligned NPS units with service-wide guidance.

Unfortunately, IWS's Non-lead Outreach Coordinator position for central CA has been vacant since 2015. Even with the IWS position refilled in southern CA in 2019, the loss of the central CA position has had a negative impact on outreach in California and beyond. With PNP's position only funded at half-time and the vacant IWS position, outreach staff capacity has limited the ability of outreach efforts in California. The USFWS is working with partners to address this shortfall but due to funding delays no new position will be filled until 2020.

In 2020, PNP and IWS will continue to look for opportunities to develop new partnerships and expand outreach. As understanding and acceptance of non-lead ammunition increases in much of California, the demand for a source of technical and detailed information has risen. At the same time, the implementation of AB711 has created many new users with basic questions about lead exposure and the performance of non-lead ammunition. To address this wide range of needs for accurate information, IWS continues to update the huntingwithnonlead.org website and associated social media outlets. Staff also hopes to continue working with new partners and at outreach venues to broaden the scope of outreach and increase accessibility to accurate information and resources. To do this, an increase in outreach capacity and funding is essential.

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 the 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. Further increasing the number of birds with GPS tags would simultaneously result in more data of higher precision. Increasing the number of condors with GPS tags remains among the highest priorities to maintain monitoring efficiency.

Management

Lead in the environment remains the primary threat to condor recovery. Condors will continue to use the 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/VWS collaboration on chelation efficacy will help inform this evaluation and will continue through 2020.

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 collaboration.

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 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. Condor release sites and all recovery partners should continue to work together to coordinate and fund successful outreach.

Recovery Planning and Multi-agency Coordination

Condor field team meetings (held approximately 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 leave meetings with direction. Developing a framework for

management decisions based on the current Montana State University-led population viability analysis (PVA) will help inform changes to management at release sites and direct well-informed decisions that are based on the best available information and science.

Appendix A

Condor mortality of PNP and VWS-managed condors 2001-2019.

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	Estimated Date of Death	Manager	Cause of Death
230	5/9/2001	VWS	Powerline Electrocution: Bird electrocuted on line (mid-span)
233	5/17/2002	VWS	Missing
212	10/30/2002	VWS	Powerline Electrocution: Bird electrocuted on line (mid-span)
254	2/19/2003	VWS	Powerline Electrocution: Bird electrocuted on line (mid-span)
260	5/20/2003	VWS	Malnutrition
170	6/15/2003	VWS	Lead Toxicosis
256	10/17/2003	VWS	Unknown: Bird recovered in desiccated state
179	12/20/2003	VWS	Missing: Bird disappeared after wildfire at Hopper NWR
164	9/30/2005	VWS	Unknown: Bird recovered in desiccated state
376	6/30/2006	VWS	Powerline Electrocution: Bird electrocuted on line (mid-span)
363	7/14/2006	VWS	Malnutrition: Bird died from poor body condition
417	5/12/2007	PINN	Trauma to neck, possible predator
301	5/15/2007	VWS	Powerline Electrocution: Bird electrocuted on line (mid-span)
307	5/16/2007	PINN	Unknown - possible snake envenomation
356	10/2/2007	VWS	Unknown: Found dead near release site in desiccated state
429	12/4/2007	VWS	Missing
278	6/25/2008	VWS	Missing
377	6/25/2008	VWS	Missing
336	9/7/2008	PINN	Lead Toxicosis
475	12/21/2008	VWS	Trauma
286	5/11/2009	VWS	Lead Toxicosis
503	7/6/2009	VWS	Trash Ingestion
422	7/12/2009	PINN	Unknown
303	10/23/2009	VWS	Lead Toxicosis
621	4/28/2011	VWS	Trauma
624	5/25/2011	VWS	Trauma
294	6/7/2011	VWS	Unknown: Bird recovered in desiccated state
499	11/9/2011	VWS	Aspiration
478	4/21/2012	PINN	Lead Toxicosis
588	7/21/2012	PINN	Unknown
298	10/22/2012	VWS	Lead Toxicosis
644	11/10/2012	VWS	Exposure: hypothermia.
318	11/30/2012	VWS	Lead Toxicosis
598	12/8/2012	PINN	Unknown
312	4/4/2013	PINN	Lead Toxicosis

681	4/13/2013	PINN	Unknown, chick - nothing in nest to recover, no necropsy report
715	5/20/2013	VWS	Unknown, chick disappeared
345	5/28/2013	PINN	Lead Toxicosis
335	6/1/2013	PINN	Lead Toxicosis
686	6/1/2013	VWS	Unknown, chick recovered in desiccated state
306	6/9/2013	PINN	Electrocution, possible indirect lead exposure
332	7/2/2013	PINN	Lead Toxicosis
194	7/11/2013	VWS	Missing
708	7/12/2013	VWS	Trauma, chick died in nest
313	8/6/2013	PINN	Lead Toxicosis
714	9/4/2013	VWS	Trauma, chick died in nest
693	9/8/2013	PINN	Unknown, chick - no collection based on remote nest location
501	9/25/2013	VWS	Missing
451	12/7/2013	PINN	Lead Toxicosis
739	4/28/2014	VWS	Unknown, chick disappeared before fledging
400	4/29/2014	PINN	Lead Toxicosis
401	6/15/2014	PINN	Lead Toxicosis (proximate) perforation of the ventriculus
444	8/26/2014	VWS	Lead Toxicosis
411	12/6/2014	PINN	Unknown: Bird recovered in desiccated state
664	12/31/2014	VWS	Lead Toxicosis
753	4/16/2015	VWS	Missing (last detected 4/16/2015)
788	4/30/2015	VWS	Unknown, chick - nothing in nest to recover, no necropsy report
713	5/15/2015	PINN	Missing (last detected 5/15/2015)
782	5/23/2015	PINN	Unknown, chick - nothing in nest to recover, no necropsy report
798	6/10/2015	VWS	Unknown, chick - nothing in nest to recover, no necropsy report
242	7/30/2015	VWS	Lead Toxicosis
769	8/29/2015	VWS	Unknown, suspected trauma
615	11/17/2015	VWS	Trauma - Predation
481	4/22/2016	PINN	Missing (last detected 4/21/2016)
742	5/1/2016	PINN	Septicemia
251	7/4/2016	VWS	Lead Toxicosis
838	12/1/2016	VWS	Trauma, fledgling euthanized due to injuries
514	3/17/2017	PINN	Anticoagulant toxicity
534	4/17/2017	PINN	Missing (last detected 4/16/2017)
583	6/28/2017	VWS	Missing (last detected 6/27/2017)
597	7/1/2017	VWS	Drowning
760	7/1/2017	VWS	Drowning
703	7/2/2017	VWS	Lead Toxicosis
460	7/7/2017	PINN	Egg binding
525	8/1/2017	PINN	Lead Toxicosis
787	12/24/2017	VWS	Drowning
614	1/19/2018	PINN	Lead Toxicosis
706	6/11/2018	VWS	Lead Toxicosis
351	4/27/19	PINN	Electrocution

835	6/7/19	PINN	Lead Toxicosis
744	6/22/19	PINN	Lead Toxicosis
418	7/1/19	PINN	Lead Toxicosis
795	10/8/19	PINN	Lead Toxicosis
799	11/29/19	VWS	Necropsy report pending
842	12/22/19	VWS	Necropsy report pending
559	12/30/19	VWS	Lead Toxicosis (preliminary)

Appendix B

Public Interest Highlights

2019 marked the 17th year of the California condor recovery program at Pinnacles National Park. Notable highlights and programmatic accomplishments include:

- 2019 marked the first time in over 100 years that three active condor nests were documented within Pinnacles National Park in the same breeding season. The breeding efforts collectively support the increasing population of the central California flock and the number of breeding adults within that population.
- One established condor pair (330 and 375) raised a nestling outside of the park completely independent of any management, surprising biologists with a fully-fledged untaged juvenile in October. It's always a "win" to see condors able to thrive and reproduce with no human assistance.
- A remote video camera in a condor nest at the park provided critical monitoring information and previously undocumented observations of a condor nest failure, a second clutch nest attempt, and eventually a successfully fledged young. The remote camera also provided valuable interpretation material used on social media and in scientific presentations to reach diverse audiences of visitors and partner organizations.
- At least three central California condors made their way into the southern CA flock territory, and one of those birds continued up to the southern border of Sequoia National Park. When that bird returned to Pinnacles, a condor from the southern CA flock flew north with him as far as San Luis Obispo. These interactions point to a future where condors will expand their territories to cover their entire historic range, and where perhaps the two California flocks will merge into one.
- Pinnacles condor program staff presented three talks to scientists, managers, and other peers at the 2019 Science Symposium in San Francisco. The Science Symposium provides an annual venue for NPS staff and cooperators to present on diverse conservation, research, and management topics and to share information and study results among peers.
- In combination with our non-lead partners in the state, non-lead outreach efforts at events such as hunting expositions, hunting club meetings, shooting demonstrations, and ranchers' workshops reached over 6,000 individuals directly in CA.

- The Pinnacles Non-Lead Outreach Biologist assisted REDW staff on non-lead outreach strategies and coordinated with the Yurok Tribe and park staff on public outreach events focused on the northern section of the state.

Appendix C

Scientific publications with PNP co-authorships

- Baker, 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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- Finkelstein, M.E., Doak, D.F., George, D., Burnett, J., Brandt, J., Church, M., Grantham, J., & Smith, D.R. (2012). Lead Poisoning and the Deceptive Recovery of the Critically Endangered California Condor. *Proceedings of the National Academy of Sciences of the United States of America*.
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- Rideout, B.A., Stalis, I., Papendick, R., Pessier, A., Puschner, B., Finkelstein, M.E.,...Smith, D.R. (2012). Patterns of Mortality in Free-Ranging California Condors (*Gymnogyps californianus*). *Journal of Wildlife Diseases*.
- Rivers, J.R., Johnson, J.M., Haig, S.M., Schwarz, J., Burnett, J., Brandt, J.,...George, D. (2014). An Analysis of Monthly Home Range Size in the Critically Endangered California Condor (*Gymnogyps californianus*). *Bird Conservation International*.