

Pinnacles National Park California Condor Reestablishment – Annual Report 2014



Pinnacles National Park Report
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Cover photo: A veterinarian and Pinnacles National Park biologists examine a nestling during a nest entry performed in 2014. Photo credit: National Park Service

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Interns

Danielle Powell, Rose Fielding, and Josh Littlejohn

INTRODUCTION

California condors are one of the rarest birds in the world and biologists have been committed to their recovery for over three decades. The Condor Reestablishment Program at Pinnacles National Park (PNP) has several objectives, with the goal of species recovery in the wild.

Project objectives include:

- 1) monitoring central California condor foraging behavior, nesting and reproduction, and population trend;
- 2) detecting and recovering mortalities so cause of death can be determined;
- 3) managing threats to condors through treatment;
- 4) increasing public awareness of threats to condor recovery; and
- 5) conducting cooperative research to aid condor recovery.

Together with the Ventana Wildlife Society (VWS), PNP manages a flock of approximately 60 condors in central California. During 2014, the Pinnacles condor program monitored all birds in the flock, which range approximately 90 miles north to south and 60 miles east to west. PNP-managed condors and VWS-managed condors make up a single flock, overlap in range, feed together, and are captured at both release sites (located in the park and in Big Sur, CA). This report focuses on Pinnacles Condor Program management of birds released from the park but includes some VWS-managed condor data.

METHODS

Population Monitoring

Condors are monitored year-round to document reproduction, mortality, and movements. Condor health, foraging, flock interactions, and breeding behavior are monitored through visual observations. Biologists use standard equipment to radio-track and monitor 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

Approximately one third of the condors in central California is monitored remotely via GPS wing tags. Argos GPS data are downloaded daily from CLS America and mapped in ArcGIS. In 2014 we also deployed Microwave Telemetry GSM (cell technology) GPS tags, Photo 1. Data from these tags are emailed daily when the tag is within cell range. In addition, US Fish and Wildlife Service (USFWS) coordinated with Movebank (an online database of animal tracking data) to have both traditional satellite tag and new GSM tag data accessible through their software. Staff use ArcGIS 10.2 and Google Earth to map and view locational data from all sources.

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, and eastern Monterey County. Prolonged stationary GPS locations or mortality signals (triggered by a radio transmitter that is inactive for six to ten hours) are tracked down using a handheld receiver and an antenna 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 USFWS condor carcass collection procedures. Data from daily tracking and monitoring, and all other activities describe databases and Excel spreadsheets.



*Photo 1. Microwave Telemetry
Satellite GPS Tag*

Trapping

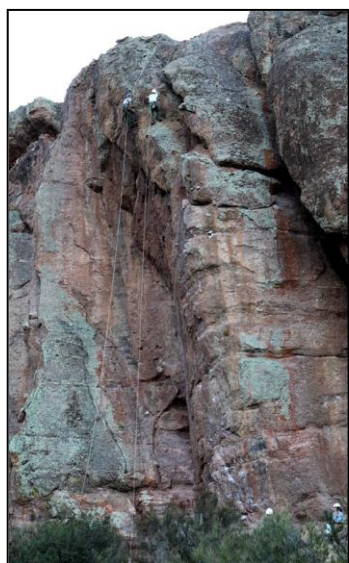
Trapping condors is critical to maintain patagial vinyl identification tags and functioning VHF and GPS tags on as many individuals as possible. In coordination with VWS, PNP conducted two trapping seasons in 2014 to measure lead levels in free-flying condors, perform transmitter maintenance, and conduct sampling related to collaborative research studies. The spring trapping season was late April through early July. The autumn trapping season was conducted from early October through early November. Opportunistic trapping was conducted throughout the year for transmitter maintenance or other needs.

Before handling condors, biologists receive extensive training in handling, bleeding, and inspecting birds from LA Zoo keepers and from experienced 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, leather gloves, and nitrile gloves for inspectors.

Nest monitoring

Biologists monitor active nest sites from survey locations 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 and nestling checks, conducted at 30, 60, 90, and 120 days of age. Once a nest site is confirmed, biologists enter the nest when an egg is approximately 30 days old to check if it is fertile. They use a high-powered flashlight in a dark space to view inside the egg. If an egg is fertile, they weigh it, measure it and leave it in the nest. If an egg is not fertile, they remove it from the nest and place an artificial egg until an egg laid in captivity is available to replace the artificial one.

During nest entries PPE includes all appropriate climbing equipment, eye protection, and leather and nitrile gloves to ensure staff and condor safety. Biologists or a veterinarian check a nestling's blood lead levels, general health, and vaccinate it against West Nile Virus, following scheduled protocols. If a nestling has high lead exposure it is evacuated from the nest for emergency care. Biologists sift nest sites for egg-shell fragments and micro-trash, which are removed when found. Annual nest entry trainings are conducted at PNP and "mini-trainings" are organized to keep staff experienced with relevant technical skills, Photo 2.



Baiting

Biologists use "clean" food supplies acquired from organic dairies and place these carcasses approximately twice per week at one or two of the established bait stations in the park. Pig and/or deer carcasses may also be fed to condors 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, Hilltop semi-permanent bait site, and Command Post temporary bait site. Established safety requirements include proper PPE, four-wheel drive training, and placement of carcasses by at least two biologists. Carcass placements are conducted at night to minimize interactions with condors and any associations with humans as food suppliers.

Photo 2. Nest entry training at Pinnacles

Remote Monitoring

Remote video cameras stationed at the captive facility and Hilltop bait site record real-time data that biologists review to observe individual birds. In addition, memory cards from motion-sensitive cameras at Command Post and Hilltop bait sites are retrieved each time food is placed and still photographs are reviewed for presence of birds. Weight data are collected using scales with perches mounted near bait. Still photos and video allow biologists to track the weight and general condition of free-flying condors.

Non-proffered Food

Non-proffered food is any carcass that PNP or VWS biologists have not placed for the condors. When condors are observed feeding on non-proffered food, biologists identify the species of the carcass when possible. Observing condors feeding on private land from public roads means carcass species identification is not always possible. Landowners are only contacted in reference to a carcass on their property when there is a specific concern, such as possible carcass contamination.

Monitoring Captive Birds

Captive condors are held at the captive pen (referred to as the flight pen), Photo 3, to minimize interactions with humans. An electrified power pole at the flight pen delivers negative reinforcement to modify condor behavior and discourage them from landing at or near power

poles when they are in the wild. During handling and prior to initial releases of young juveniles, biologists monitor captive condor health and interactions at the captive pen and through remote video.

Management

The main threat to central California condors is lead exposure, predominantly from ammunition fragments in scavenged carcasses. Other risk factors may include micro-trash consumption, West Nile Virus exposure, electrocution at or near power poles, and human interactions. PNP biologists adhere to standard procedures and established protocols to study and reduce the impact of these risks.



*Photo 3. Captive pen (facility),
Pinnacles National Park*

Treatment

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 and LeadCare II Analyzers, suitable for field use and used respectively at PNP and in Big Sur, were used to collect immediate results that would determine whether a condor needed treatment for high blood lead levels. The threshold used to initiate chelation treatment was a blood lead value of 35 µg/dL or greater. In addition to blood sampling, a new radiograph unit at PNP was used to help inform treatment decisions. Condors with blood lead levels between 35 and 65 µg/dL on a LeadCare Analyzer were radiographed in the Condor Care Unit (CCU) at the park. Radiographs were then emailed to LA Zoo for veterinarian review. Birds with possible metallic densities in their gastrointestinal tract or any bird with blood lead levels above 65 µg/dL were transported to the LA or Oakland Zoos for treatment. Condors with clear radiographs and blood lead levels between 35-65 µg/dL were treated at PNP when staffing allowed. Condors with clear radiographs and blood lead levels between 25 and 35 µg/dL were held in the captive facility at PNP for a lead depuration study.

Veterinary care

PNP biologists are permitted to conduct basic first aid to 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

PNP biologists administer West Nile Virus vaccinations and boosters on a schedule provided by veterinarians. In 2014, the protocol remained the same as recent years, with a goal of vaccinating 100% of the flock on an annual basis. We followed this protocol for all birds we were able to capture.

Hazing

Hazing is needed when condors endanger themselves by staying in close proximity to humans or human infrastructure. Hazing methods vary depending on location and include clapping and running, clapping wood blocks together, spraying water with a water cannon, using an air horn, and throwing pebbles near, but not at, a condor.

Collaborative Research

In 2014, Pinnacles biologists continued to work closely with researchers at US Geological Survey (USGS) and the University of California at Santa Cruz (UCSC) to gather scientific data measuring condor responses to environmental risk factors. We sent blood samples collected during handling, emergency responses, and nest entries to UCSC to measure isotopic signatures of lead in condors. Feather samples were also sent to UCSC to measure lead exposure events in individual condors over time. Samples from food sources and blood samples were sent to USGS researchers. Project results will be used to confirm which environmental lead sources condors are ingesting and how this affects condor health, behavior, and survival over time.

Outreach

As lead exposure in wild condors continues to be the primary challenge to recovery, we have continued outreach on the impacts of spent ammunition to scavenging wildlife with park staff, local landowners, ranchers, hunters, and the general public. The Pinnacles Condor Program has dedicated the time of one biologist to conduct outreach and work closely with the Institute for Wildlife Studies (IWS), VWS, and other partners to collaborate on outreach efforts. Additionally, during the course of routine fieldwork, the field staff speaks with park visitors and local landowners. Outreach is conducted on community, statewide, and larger scales 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 the operations for water as well as the availability of breeding and foraging habitat. Carcasses left on the land from these operations are important food for condors, as long as they have not been shot with lead ammunition. Hunters and ranchers already have a long tradition of wildlife stewardship, yet increased partnerships and open communication are needed to address the impacts of lead ammunition. The success of condor recovery efforts relies on eliminating condor exposure to lead.

PNP's outreach strategy continues to promote education and voluntary efforts to reduce the impacts of spent lead ammunition on wildlife health. Our focus is to keep outreach messages consistent across a variety of audiences. The core concept is focused on the fact that condors benefit from hunting and ranching operations when non-lead ammunition is used. With hunting

and ranching audiences, we focus on available alternatives to lead ammunition and how to achieve the best performance from non-lead ammunition. With park visitors and the general public, we stress the need for continued hunting and ranching, as well as how those traditions play a role in wildlife conservation.

Personnel

Implementing a long-term endangered species recovery program requires consistent staff capacity, which results in well-trained, experienced staff. Our program consists of a manager, wildlife health outreach coordinator, two field crew leaders, a biological science technician, and two interns, all working full-time and primarily year-round. An additional wildlife biologist works with the program full-time for half of the year.

Volunteers also provide vital program support and receive extensive training prior to assisting in the field. Volunteers are asked to make a commitment to the program for a minimum of two days per month. The Pinnacles condor volunteer program continued to expand during 2014. They assisted in tracking, field observations, and a wide variety of logistical tasks that support management of the species. In 2014, 27 volunteers contributed 3,982 hours—up from 2,123 hours in 2013. Two full-time interns contributed over 3,500 hours.

RESULTS

Population Monitoring

In January 2014, PNP managed 27 condors, 14 males and 13 females, which made up approximately half of the flock in central California. There were four nesting attempts that included at least one PNP condor. Of those, one was successful in producing a fledged chick. Other additions to the population this year included seven juveniles, which were transferred to PNP in October and are scheduled for release in early 2015. Of the seven, two females and two males were from the Oregon Zoo; two males were from the World Center for Birds of Prey in Boise, Idaho; and one additional male was from the Los Angeles Zoo. There were three mortalities of PNP-managed condors in 2014. Including the captive-reared juveniles planned for release, the total population of PNP-managed condors grew to 32 birds, 18 males and 14 females, by the end of the year.

Survival Monitoring

Throughout the year, PNP monitored radio and GPS-tagged condors almost daily. We observed condors without functioning tags opportunistically, often when they were near other radio tagged birds that were being tracked. This year, there were 1,788 visual observations of wild condors by PNP biologists. Including birds in captivity, there were 2,422 visuals of condors by PNP biologists. On 301 days of the year staff recorded at least one visual observation.

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 ill.

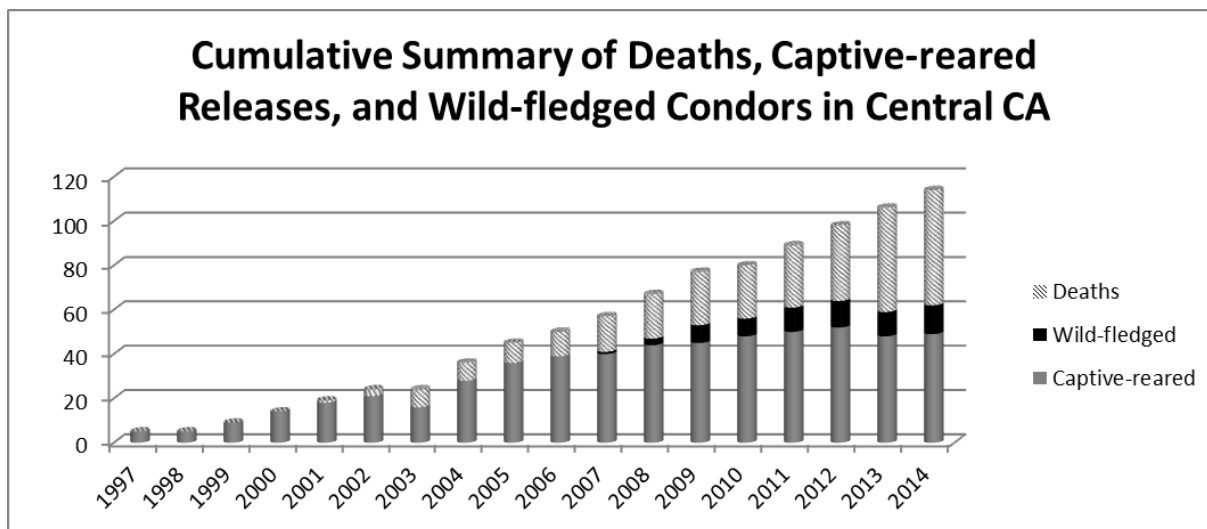
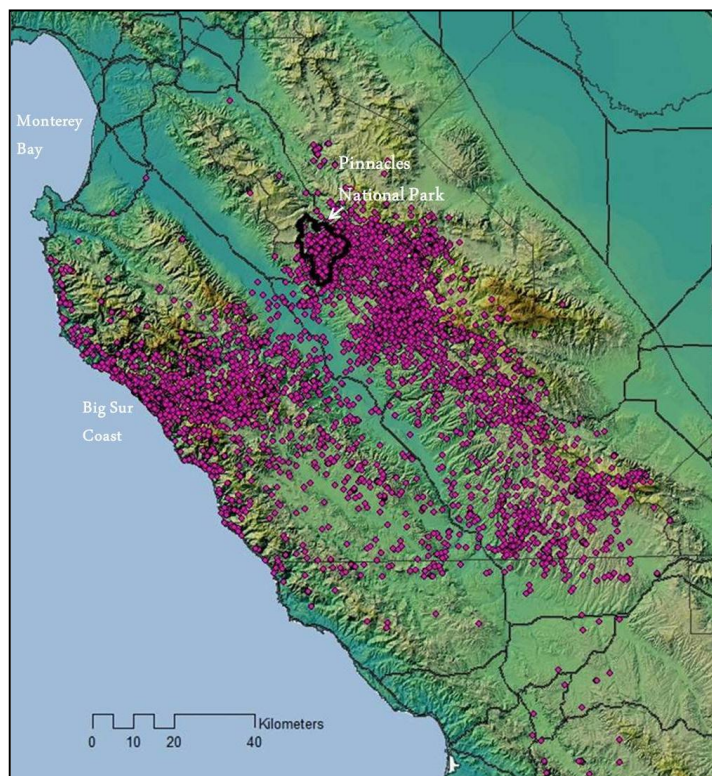


Figure 1. Chart presents total *cumulative* deaths and current condors (both wild-fledged chicks and captive-reared) managed by PNP and VWS in the central California area. *VWS data provided by J. Burnett, Big Sur Condor Program Coordinator and Senior Biologist.*

Staff used GPS data to efficiently locate up to sixty-five percent of PNP-managed birds daily and these data often directed where staff focused efforts for a given day.



Condors released by both VWS and PNP (all condors ranging across central California) used 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 central California condors in 2014. Figures 3 and 4 demonstrate the fine scale of GSM GPS transmitter data collection, as well as the extensive single-day movements condors make on a regular basis. Because condors are social, monitoring them via GPS transmitters adds great efficiency to locating all released condors, including those with no functioning radio or GPS transmitters.

Figure 2. Location data from selected PNP-managed condors with GPS transmitters in 2014.

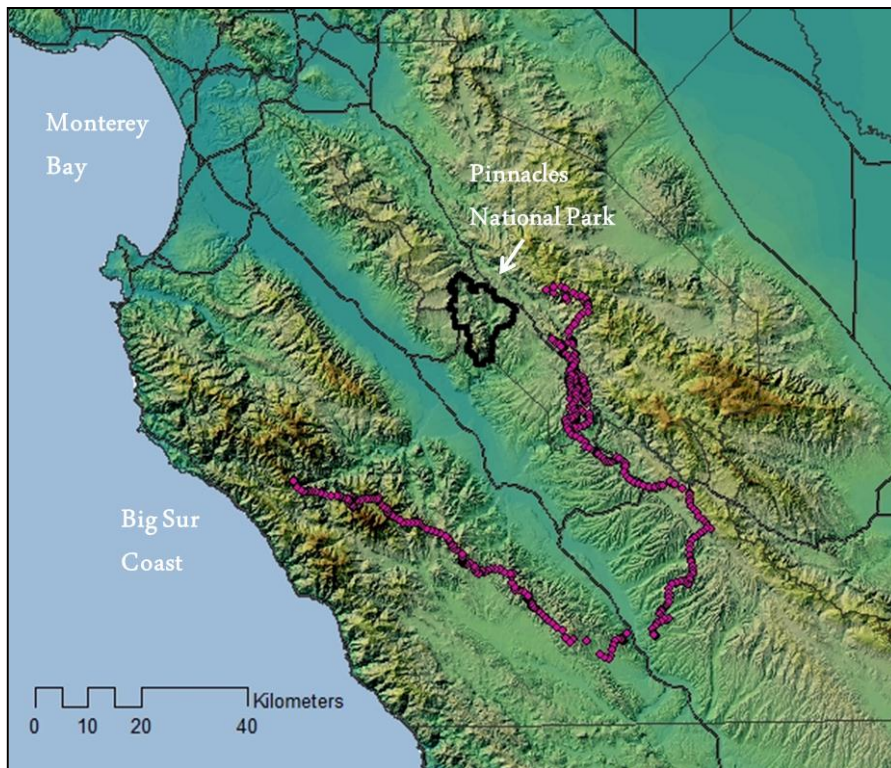


Figure 3.
Day 1 of 2: GSM
GPS location data
recorded for 431
on a single day in
August 2014,
starting inland
and traveling to
the coast.

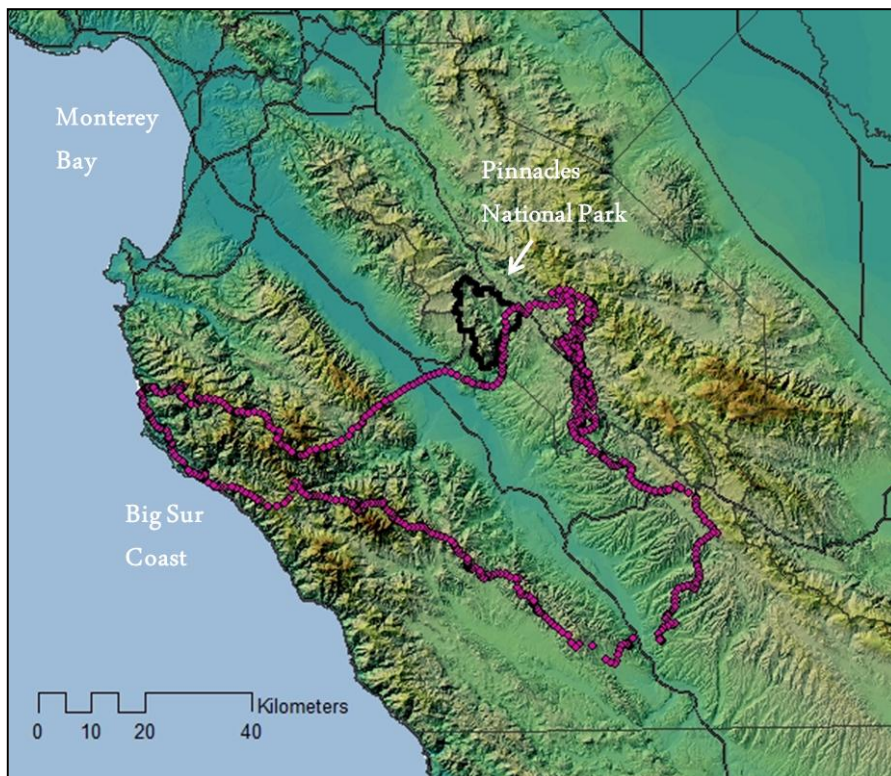


Figure 4.
Day 1 and 2: The
following day 431's
data continues from
where it ended the
day before and shows
his return from the
coast to the same area
where he began the
previous day. The data
documented 431
crossing the Salinas
Valley in 15 minutes
during his flight inland.

Mortality

In 2014, three PNP-managed condors (400, 401, and 411) and two VWS-managed condors (444 and 664) died. Based on laboratory necropsy reports, lead toxicosis was the cause of death for three of the birds, with the final necropsy reports still pending for 411 and 664. Lead continues to be the primary cause of death for condors in central California, Table 1.

Table 1. Condor mortality of PNP and VWS-managed condors since 2001. *VWS data provided by J. Burnett, Big Sur Condor Program Coordinator and Senior Biologist.*

ID	Date Collected	Managed By	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 wild fire at Hopper NWR
164	9/30/2005	VWS	Unknown: Bird recovered in desiccated state
376	7/2/2006	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	5/18/2007	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	9/5/2008	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	11/17/2011	VWS	Aspiration
478	4/10/2012	PINN	Lead Toxicosis
588	7/29/2012	PINN	Unknown - possible electrocution
298	10/23/2012	VWS	Lead Toxicosis
644	11/10/2012	VWS	Exposure: hypothermia.
318	11/30/2012	VWS	Lead Toxicosis
598	12/8/2012	PINN	Unknown
312	4/10/2013	PINN	Lead Toxicosis
681	Spring 2013	PINN	Unknown, chick - nothing in nest to recover, no necropsy report
693	Spring 2013	PINN	Unknown, chick - no collection based on remote nest location
715	5/20/2013	VWS	Unknown, chick disappeared
345	5/29/2013	PINN	Lead Toxicosis
686	6/1/2013	VWS	Unknown, chick recovered in desiccated state
335	6/6/2013	PINN	Lead Toxicosis
306	6/9/2013	PINN	Electrocution, possible indirect lead exposure
332	7/3/2013	PINN	Lead Toxicosis
194	7/11/2013	VWS	Missing
708	7/12/2013	VWS	Trauma, chick died in nest
313	8/8/2013	PINN	Lead Toxicosis
714	9/4/2013	VWS	Trauma, chick died in nest
501	9/25/2013	VWS	Missing
451	12/8/2013	PINN	Lead Toxicosis
400	4/16/2014	PINN	Lead Toxicosis
401	6/6/2014	PINN	Lead Toxicosis (proximate) perforation of the ventriculus (immediate)
444	8/16/2014	VWS	Lead Toxicosis
411	December 2014	PINN	Necropsy results pending
664	12/31/2014	VWS	Necropsy results pending

Trapping

PNP conducted trapping from late April to early July and again from early October through early November. In addition to scheduled seasonal trapping, some opportunistic trapping occurred throughout the year when specific birds were captured for transmitter replacement or other needs. Capture success in the spring was moderate, but was limited in the fall. Very few condors came to the Pinnacles trap in the fall and the season was limited due to staffing constraints. Twenty-three PNP-managed condors were trapped in 2014 at the Pinnacles and Big Sur facilities. Ten of those 23 were trapped in both spring and fall seasons.

To measure capture effort and success over time we recorded the total number of days per season when staff were specifically present at the facility with the intent to trap birds. PNP spent 110 person days trapping and captured 38 individuals, which includes opportunistic trapping efforts dictated by the arrival of an infrequently captured individual in the park. Capture data are summarized in Table 2, which only includes those condors that were captured at the PNP facility.

Table 2. 2014 PNP trapping effort and captures of PNP and VWS-managed condors at PNP.

Trapping Season	Date Range	Total handling days*	Total captures**	Total individuals captured***	Person Days
Spring	Late April to early July	10	30	30	54
Fall	Early October to early November	2	6	6	38
Opportunistic	Year round	2	2	2	18
Totals		14	38	38	110

*Days 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.

**Number of condors trapped including multiple captures of the same individual during the given time frame.

***Number of individual condors trapped during the given time frame at Pinnacles.

Reproduction

In 2014, there were nine central California nests, four of which included at least 1 PNP-managed condor, Table 3. In total, five individual PNP-managed condors attempted nesting this year; three were paired with VWS-managed birds and two were paired together. For central California there were four fledged checks, one from a pair that included a PNP-managed condor. Figure 5 includes three 2014 nests of PNP-managed birds that had confirmed eggs; although one nest's egg incubation was inferred based on GPS tracking data.

PNP Condor Nesting Details

Condors 219 and 310 have been paired since 2010. PNP dedicated over 150 hours observing their nest in Los Padres National Forest. Together with other project partners, PNP performed five nest entries there: one egg fertility check and four nestling checks. Their chick, 745, fledged

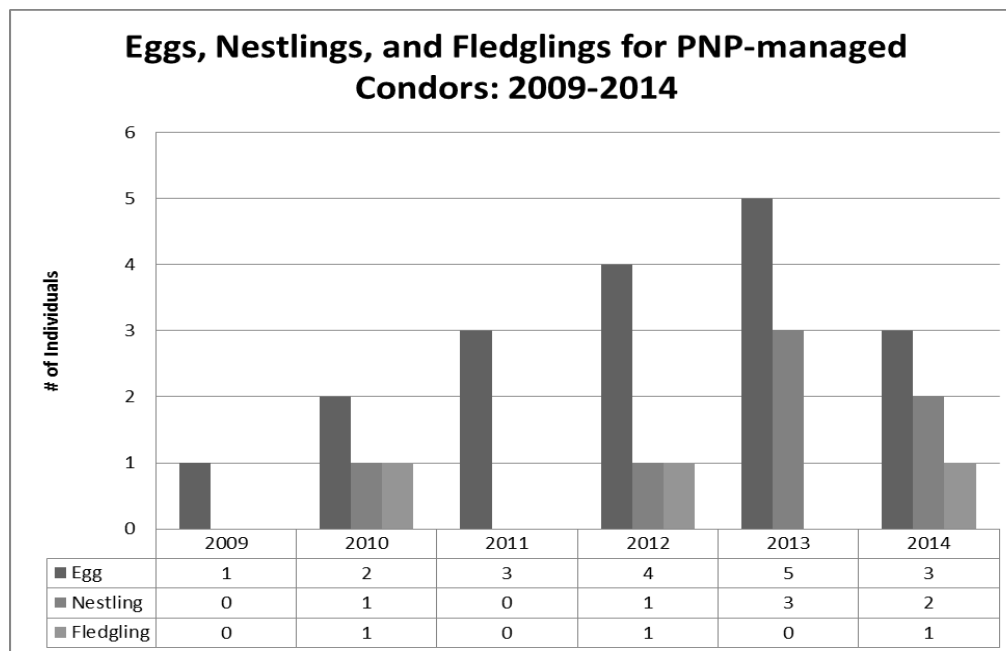
in September. No microtrash was found in this nest. 351 and 418 are two PNP-managed condors that nested for the first time in a redwood tree in the Big Sur area. There was an initial egg check, but the redwood was unsafe for entries. The egg hatched in the nest, but failed afterwards. In his first ever nesting attempt, 431 (a seven-year old male) paired with 375, a VWS-managed bird. Because of their nest's remote location in San Benito County, nest entries were not possible. PNP monitored the status of the nest using GPS tag data. Based on the data, we determined the egg lay date, although this nest failed prior its hatching. PNP-managed condor 438, a 7-year old female, paired with 199, a 15-year old male managed by VWS. However, the nest location or breeding activity was never confirmed. Table 3 displays 2014 condor nesting results for central California.

Table 3. 2014 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	Wild Egg Fate	Foster Egg Used?	Foster egg ID	Nestling studbook	# of Nest Entries	Nest Outcome
PC	251	222	BS114	02/25/14	Failed, egg crushed	No	NA	NA	1	Fail
NM	351	418	BS214	02/05/14	Wild egg hatched in nest	No	NA	739	1	Fail
MC	167	190	BS314	03/08/14	Wild egg hatched in nest	No	NA	753	5	Fledge
BC	168	208	BS414	01/24/14	Wild egg hatched in nest	No	NA	729	5	Fledge
PC	251	222	BS514	03/20/14	Failed, foster egg crushed	No	NA	NA	1	Fail
TI2	219	310	PN114	01/28/14	Wild egg hatched in nest	No	NA	745	5	Fledge
SB	431	375	PN214	03/20/14	Failed, unknown	No	NA	NA	0	Fail
SC	199	438	BS614	02/10/14	Failed, unknown	No	NA	NA	0	Fail
SC	209	231	BS714	02/05/14	Wild egg hatched in nest	No	NA	769	0	Fledge

PNP Nesting Summary 2009 - 2014

Both VWS and PNP intensively manage condor nests to maximize the likelihood of nest success. This includes 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. Therefore, interpreting nesting results requires consideration of our active and intensive management actions, which increase the chance of nest success. In addition, a greater number of condors in the

Figure 5. Egg, nestling, and fledging counts for PNP-managed condors since 2009.

central CA area reach breeding age each year, thereby increasing the number of nesting attempts. The first nest to ever include a PNP-managed condor was in 2009. Nesting attempts by PNP-managed condors increased over time, Figure 5. A decline in the number of eggs in 2014 was most likely due to mortality of seven breeding-age condors the previous year.

Baiting

Proffered carcasses were placed at three locations in PNP: the captive pen, Hilltop, and Command Post. Most of the carcasses were calves procured from organic dairies in Modesto, CA. In 2014, we placed 131 calves and one rabbit for condors. Of the proffered carcasses, 62 calves were used to bait the captive pen and feed any condors that were captive. During trapping seasons carcasses were placed exclusively at the captive pen to increase trapping success.

Remote Monitoring

During 2014 over 200,000 GPS locations were downloaded from transmitters on 20 PNP-managed condors. Fifteen of the condors with traditional Microwave Telemetry Argos satellite GPS transmitters collected 35,471 location points and five condors with Microwave Telemetry GSM GPS transmitters collected 170,350 points. To supplement radio and GPS monitoring, thousands of still photos and video hours were recorded and reviewed regularly throughout the year, Photo 4.

Non-proffered Food

Biologists observed 11 non-proffered feeding events (some of which occurred over several days) including 109 individual observations of condors feeding on non-proffered food sources. Several feeding events involved the same food source over several days. Biologists identified condors feeding on three cows, one deer, two calves, and five pigs at observed non-proffered feeding events.



*Photo 4.
Photo
taken with
remote
camera*

Management

Captive-bred Releases

In October 2014, we received eight birds from the USFWS. Seven were pre-release juveniles and one was an adult mentor bird. Of these, there are just two females. We are planning to release the juveniles in early 2015 from the park's facility. The adult mentor bird will be transferred back to USFWS after the juveniles are released.

Lead Sampling

Blood lead level sampling continued to be a priority management action for any bird captured at PNP, whether captured during a scheduled trapping season or opportunistically for other needs. Figure 6 summarizes the number of birds with blood lead levels greater or less than 15 µg/dL. In 2014, a total of 24 PNP-condors were tested. It is important to note that birds below 35 µg/dL do not receive chelation treatment, based on current condor recovery program protocol and that condors captured at PNP with blood lead levels between 25 and 35 µg/dL are radiographed and held for a lead depuration study.

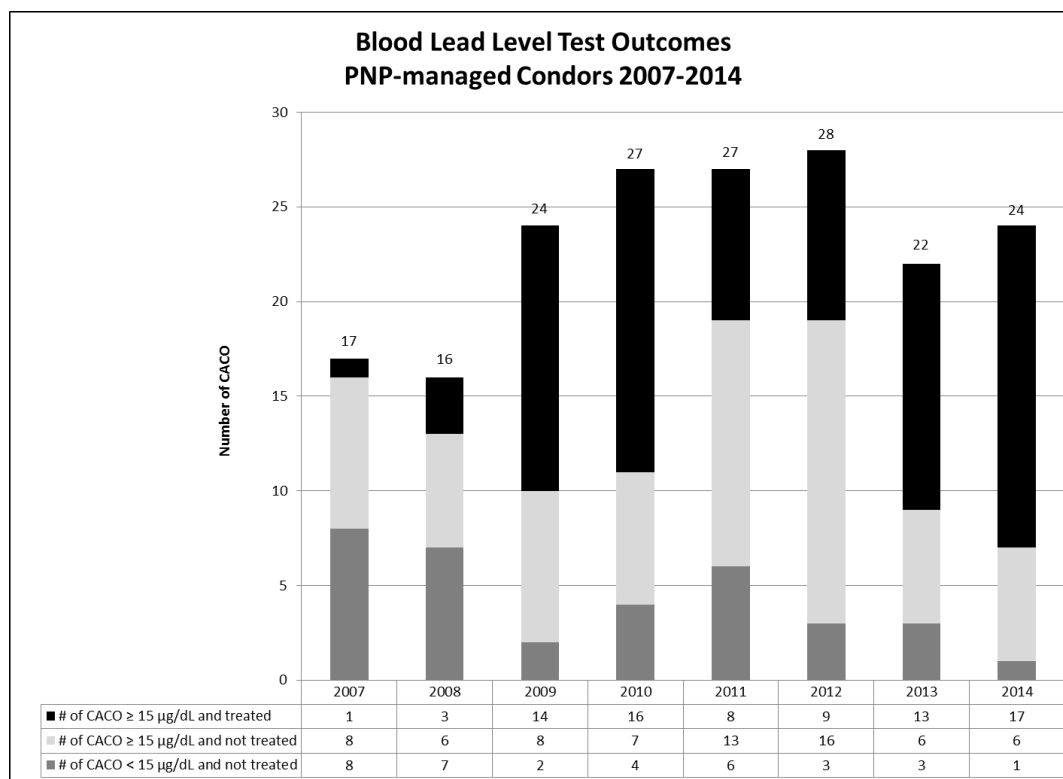


Figure 6. Treatment and blood lead values for PNP-managed condors 2007 – 2014.

Treatment

Chelation

In 2014, seventeen Pinnacles condors were treated for elevated blood lead levels. Two birds were treated at two different times in the year. Chelation treatment for birds with lead values between 35 µg/dL and 65 µg/dL were usually treated in PNP's CCU when staffing allowed and

those greater than 65 µg/dL were either treated at the Oakland Zoo or LA Zoo. Pinnacles staff treated eight condors in the CCU, including one VWS-managed condor. The Oakland Zoo began treating condors for lead poisoning this year and five Pinnacles condors were treated there. LA Zoo staff treated five Pinnacles condors that recovered and were released again, and another two that did not survive. Two condors, 463 and 481, treated at the LA Zoo suffered from complications of lead toxicosis and were held for about five months. After extensive treatment, 463 and 481 were placed into a flight pen at LA Zoo with other condors for over two months to allow them to fully recover and spend time with limited human interaction before being released.

Results from blood lead sampling vary by year. Figure 6 summarizes PNP-managed blood lead level data since 2007 received from laboratories and the number of captured condors that received chelation treatment.

Radiographs

When condors had elevated blood lead levels based on the LeadCare Analyzer, radiographs helped determine whether metallic densities were present. Veterinarians at the LA and Oakland Zoos radiographed multiple condors during 2014. PNP also radiographed condors at the park's CCU to inform decisions on the best treatment location for birds with high blood lead levels. In addition, several PNP condors were radiographed at the Avian and Exotic Clinic of the Monterey Peninsula (Avian Clinic) to evaluate possible injuries, Table 4.

Surgeries

In 2014, several condors required surgeries to remove foreign objects or to repair a patagial tag hole. Surgeries took place at the LA Zoo, Oakland Zoo or the Avian Clinic, Table 4.

Vaccination

In 2014, West Nile Virus vaccinations were given to 21 Pinnacles condors, following the existing protocol of one injection per year. Some condors were not captured and therefore did not receive vaccinations.

Hazing

Pinnacles biologists hazed condors on seven different occasions during 2014. Those events included both PNP and VWS-managed condors. The condors were hazed for a variety of reasons and using several different methods. Three birds were hazed after landing close to people and trails. Fifteen birds were also hazed due to their close proximity to a road. Six birds were hazed away from the facility during handlings. Of the condors hazed by Pinnacles staff, four had to be hazed more than once: 340, 564, 589, and 664 (managed by VWS).

Table 4. Radiograph and surgery information for PNP-managed condors and VWS condors radiographed at the PNP CCU in 2014.

Bird	Clinic	Density Observed in Radiograph	Surgery
231	PNP	No	n/a
310	PNP	No	n/a
310	Avian Clinic	No	No surgery needed; care provided for possible leg injury
317	Avian Clinic	No	No surgery needed; care provided for possible leg injury
340	PNP	No	n/a
340	Oakland	Yes, one fragment on the initial radiograph	No surgery, the bird was able to cast eliminate it
375	PNP	No	n/a
400	LA Zoo	Yes, incoming radiographs showed this bird had densities in its crop and ventriculus.	Yes, first flushed crop to remove some, then surgery to remove densities in ventriculus
401	LA Zoo	Yes, densities in the crop and in the ventriculus	No, too small for veterinarian to remove
405	Oakland	No	n/a
411	Oakland	No	n/a
418	PNP	No	n/a
431	Oakland	No	Surgery repair of patagium tag hole
438	LA Zoo	Yes, one small and one large density in ventriculus	No, bird was able to cast it up
444	PNP	Yes, metallic object	Transferred to Oakland Zoo; no surgery needed, bird was able to cast it up
448	LA Zoo	No	n/a
463	LA Zoo	Yes, 5 small densities in crop and one large one in	Yes, surgery on crop and ventriculus to remove densities.
481	LA Zoo	Yes, small density in crop and 7 small pellet shaped densities in lower intestines.	No, manually removed 3 metal fragments out the crop. Bird eliminated the rest on her own.
543	LA Zoo	No	n/a
583	PNP	No	n/a
589	PNP	No	n/a
589	Avian Clinic	n/a	Surgery repair of patagium tag hole
602	PNP	No	n/a
602	Oakland	No	n/a
626	PNP	No	n/a
626	PNP	No	n/a
626	Avian Clinic	No	No surgery needed; care provided for possible leg injury
664	PNP	No	n/a
704	Avian Clinic	No	n/a

Collaborative Research

Case Study of Lead-related Mortality

Researchers at UCSC conducted a comprehensive assessment postmortem of VWS-managed Condor 303, whose death was due to lead poisoning in 2009. UCSC analyzed a total of 78 samples related to her case, including: five feathers, seven blood samples from 303, three blood samples from 303's chick, a blood sample from 303's mate, tissue samples (liver, kidney and bone), her egg shell, and the fragment that was recovered when she died. This case is in preparation for publication (target journal Environmental Science and Technology) and is the most comprehensive assessment of the lead exposure history of a condor to date.

Feather and Blood Lead Isotopic Fingerprinting

Evaluating lead concentrations and isotopic compositions in sequential feather segments from individual birds provides critical information on the degree, frequency, and severity of lead exposures in California condors. In 2014, Pinnacles continued collaboration with Dr. Don Smith's Environmental Toxicology Laboratory at UCSC on projects analyzing blood and feather samples for lead concentration and isotopic ratios. In support of this research, we measured and marked at least one growing feather when a condor had any growing primaries at the time of capture, Photo 6. If a condor had molted a previously sampled feather, we collected another sample when possible. During 2014, a total of 18 feathers were notched for measurement on 16 individual condors. We collected 29 measurements made during the year. We also collected one feather sample each from four individuals.

In addition to feather studies, blood lead isotope ratios were analyzed at UCSC. During each initial handling of a condor we collected a blood sample and, when possible, a second sample at a later date. In total, PNP biologists collected 37 blood samples from a total of 23 Pinnacles-managed condors for this study. Condor isotopic ratios can be compared to ammunition and other possible sources of lead exposure.



Photo 6. Feather sampling during condor handling

Feather Growth Rates

If a condor was held in the captive pen for a week or longer for chelation or another management issue, or if a bird was trapped twice while a single feather was growing, biologists collected feather length measurements on multiple dates

from the same primary feather. The purpose of these measurements was to determine how consistent feather growth rates are over time. We continue to collect these measurements opportunistically.

Contaminants Study

This study is a collaboration between PNP and USGS in Portland, OR. The purpose is to identify contaminant threats to condor health and assess nutritional adequacy of food resources to assess current management strategies and better understand ways to minimize risk to environmental contaminant exposure. The research is focused on four contaminant groups to which condors are likely exposed: Polychlorinated biphenyls (PCBs), Organochlorine pesticides (OCs); Polybrominated diphenyl ethers (PBDEs), and Mercury (Hg). Primary objectives include: analysis of condor food resources for contaminants and nutrient composition; analysis of wild condor blood samples for contaminants, and quantification of relative contributions of the variety of food sources to condor diets using stable isotope analyses. Sample collection began in 2013 and continued through fall 2014. In total, PNP sent 18 non-proffered and 15 proffered food samples to the USGS laboratory, in addition to 28 blood samples.

Chelation Effectiveness

To better understand chelation effectiveness in California condors, we took blood samples from birds that required treatment after they received two and four chelation treatments and then analyzed these samples for their lead values. These data should indicate how fast chelation treatment reduces the lead load in condors. In addition, we assessed natural lead depuration when treatment was not given by collecting blood samples once per week for a two week period from condors with field lead values >25 and <35 $\mu\text{g/dL}$. These data may help inform future chelation effectiveness research. This work will continue in 2015. In addition, a focused UCSC / PNP chelation efficacy research study is beginning in 2015 that will evaluate the benefits of chelation on condors over time in terms of reduced mortality.

Outreach

A large component of the condor recovery program is educational outreach and interpretation. As a release site in a national park, our public recognition gives us an opportunity to reach thousands of people from all over the country and 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 also one of our duties as a national park.

In 2014, the condor program continued to expand interpretive contacts (in-person discussions about condors and the recovery program). While radio tracking, biologists were available to answer questions and provide visitors with informal interpretation about condors. Condor staff and volunteers spoke with 4,435 park visitors and local residents while tracking within the park and 48 individuals while tracking outside the park boundary. In addition to informal contacts, biologists presented nine educational programs at our park amphitheater to over 550 visitors.

Biologists also staffed a table at the 2014 BioBlitz at Golden Gate National Recreation Area, where they spoke with more than 350 individuals.

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 outreach funds and 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. Our primary partner for non-lead outreach was IWS. We also had opportunities to offer technical support to VWS for their Free Non-lead Ammo program.

Targeted Non-lead Outreach

This was our ninth year conducting targeted non-lead outreach. In 2014, PNP and its partners participated in a total of 36 events over 42 days and had conversations with 3,106 individuals (these numbers do not include many informal conversations and discussions that took place throughout the year with locals and others interested in the issue), Table 5. Two of the 36 events were in Montana and the rest were in California. Our most valuable efforts continue to be at either end of the spectrum of outreach opportunities. At one end of that spectrum, one-on-one conversations with individual landowners, ranchers, and hunters have been invaluable in developing relationships that build partnership and understanding on this contentious issue. On the other end of the spectrum, large events, such as the International Sportsmen's Exposition, allow us to reach a very large number of hunters and ranchers at a single event. Presenting and updating information regularly on social media sites, an effort led by IWS, is another valuable outlet.

Outreach highlights for 2014 include: continued work with California Department of Fish and Wildlife (CDFW) Hunter Education Program, IWS hiring a coordinator for work in southern California, and funding to support an IWS Range Rider program. Working with CDFW's Hunter Education Program has been a tremendous success in getting information out to instructors and new hunters throughout the state. IWS's new Non-lead Outreach Coordinator will focus on outreach in southern California and the Sierras. He will work in close coordination with the central CA Coordinator to expand capacity and mutually support each other's efforts. Through a grant from PNP, IWS will be create a Range Rider program to work with PNP's local community. Based on successes of programs such as the Blackfoot Challenge, which partnered ranching with predator conservation, as well as a wide variety of other programs that provide assistance for projects benefiting ranching and wildlife, this program will build on existing efforts to increase partnerships, communication, and cooperation between private landowners and the condor program.

In 2015, we will continue to look for opportunities to develop new partnerships and expand outreach. Misinformation continues to be one of the largest challenges for non-lead outreach. We continue to receive questions and criticism that spent lead ammunition has not been documented as having a negative impact on condor survival or the health of other scavenging wildlife. To address this need for accurate information, IWS updated the huntingwithnonlead.org web site in 2014 and opened Youtube and Vimeo channels to host

videos produced in 2013. We will continue to work with new partners and social media outlets to broaden the scope of our outreach and increase accessibility to accurate information and resources.

Table 5. 2014 IWS and PNP Non-lead Outreach Events

Date	Days	Event	Location	Type of Event	Contacts
1/9/2014	4	International Sportsmen's Expo	Sacramento, CA	Booth	1216
1/21/2014	1	California Rangeland Conservation Coalition Summit	Oakdale, CA	Table	29
1/27/2014	1	San Benito Co. Fish and Game Advisory Commission	Hollister, CA	Update	6
2/22/2014	1	CADFW Hunter Ed Instructor Conference	Lemoore, CA	Table	160
2/28/2014	3	Central Valley Sportsmen's Show	Bakersfield, CA	Booth	395
3/8/2014	1	CADFW Hunter Ed Instructor Conference	Morro Bay, Ca	Table	75
3/22/2014	1	CADFW Youth Turkey Hunt	Gilroy, CA	Shooting Demo	30
3/24/2014	1	San Benito Co. Fish and Game Advisory Commission	Hollister, CA	Update	10
4/4/2014	1	Hunter Ed Course	San Benito, CA	Talk	9
4/5/2014	1	Advanced Hunter Ed Deer Clinic	Victorville, CA	Table, Demo	50
4/11/2014		Pinnacles National Park Seasonal Training	Hollister, CA	Shooting Demo	18
4/12/2014	1	Advanced Hunter Ed Pig Clinic	Lockwood, CA	Table	80
4/26/2014	1	Advanced Hunter Ed Black Powder Clinic	Atwater, CA	Demo	20
4/29/2014	1	Missoula Film Screening	Missoula, MT	Video, Toolkit	100
5/3/2014	1	CADFW Hunter Ed Instructor Conference	Big Bear Lake, CA	Table, Ammo Raffle	50
5/17/2014	1	CADFW Hunter Ed Instructor Conference	Susanville, CA	Table	
5/31/2014	1	Advanced Hunter Ed Deer Clinic	Canada De Los Osos, Gilroy, CA	Table, Demo	53
6/28/2014	1	Advanced Hunter Ed Pig Clinic	Canada De Los Osos, Gilroy, CA	Table, Demo	74
7/12/2014	1	Society for Conservation Biology	Missoula, MT	Presentation	20
8/12/2014	1	Monterey Co. Fish and Game Commission Mtg	Salinas, CA	Presentation	15
8/27/2014	2	Condor Field Team Meeting	Santa Barbara, CA	Table, Presentaion	150
9/8/2014	1	Hunter Ed Course	Pinnacles National Park	Presentation	5
9/13/2014	1	Canada de los Osos Youth Deer Hunt	Gilroy, CA	Demo	30
9/16/2014	1	CA Fish and Wildlife Commission-Wildlife Resource Committee Mtg	Sacramento, CA	Presentation	75
9/22/2014	1	San Benito Fish and Wildlife Advisory Commission	Hollister, CA	Meeting	10
10/3/2014	3	Mojave National Reserve Youth Quail Hunt	Mojave National Reserve	Demonstration,	150
10/7/2014	1	Kern County Wildlife Commission Mtg	Bitter Creek	Presentation	15
10/10/2014	1	UC Berkely Wildlife and Conservation Seminar	Berkeley, CA	Presentation	30
10/22/2014	1	Pinnacles National Park Ranger Corp	San Benito, CA	Shooting Demo	3
11/4/2014	1	Kern County Cattlemen's Association Mtg	Wasco, CA	Presentation	25
11/7/2014	1	Advanced Hunters Education Cooking, Prep day	Compton, CA	Meeting	10
11/14/2014	1	Southern Counties Commissions Mtg's	Los Angeles, CA	Presentation	15
11/15/2014	1	Hollister Boy Scout Turkey Shoot	Hollister, CA	Presentation	50
11/20/2014	1	LA Zoo Staff and Volunteer Presentation	Los Angeles, CA	Presentation	60
12/6/2014	1	Pinnacles Partnership Bird Tour	Pinnacles National Park	Talk	8
12/16/2014	1	Hollister Ranchers Workshop	Hollister, CA	Table, Ammo Raffle	60

Note: Some additional outreach methods are more difficult to quantify the number of people reached, such as: media, requests for assistance from partners, electronic toolkits sent to other NPS units or other organizations, NPS unit coordination, and the production of outreach material for public information.

General Community Outreach

PNP is surrounded by private lands which provide condors and many other native wildlife species with important habitat. The Pinnacles outreach program includes: building relationships with land owners and managers to foster communication; helping address any human/wildlife conflicts; and building trust within the community. We request permission to access private land as needed to follow up on dropped transmitters, sick or injured birds, and possible nesting activity. These informal meetings, as well as radio tracking along public roads, create opportunities to answer questions about the condor program and interact one on one with land managers and owners who can have a direct positive impact on condor survival. Ranching and hunting lifestyles are not only compatible with, but are necessary to condor recovery in central

California. Working together with the community, we hope that these traditions remain viable in the lands surrounding the park.

RECOMMENDATIONS AND DISCUSSION

Monitoring

Maintaining staff capacity and efficient monitoring creates a well-rounded program, including outreach and research components that are coordinated with condor management. The 2014 increase in the number of condors with GPS tags 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 and better use of personnel time. In addition, although nest monitoring via radio tracking, observations, and GPS tags are sufficient to determine nest location and outcome, these tools cannot necessarily address questions on the fate of an egg or nestling. We recommend installing nest cameras whenever possible and will implement a nest camera program in 2015.

Management

With three currently confirmed central California flock condors dead due to lead poisoning in 2014, 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 that offer excellent foraging and roosting habitat, Figures 2, 3, and 4. Addressing the threat of lead on these lands is an ongoing need and focus, 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 recovery programs and release sites determine when it is most useful. We recommend chelation treatment for condors be further researched and reviewed to increase our understanding of the options it provides. The NPS / UCSC collaboration on the chelation efficacy research is funded and will continue through 2018.

Research

Each research project conducted to date has informed management decisions that affect the recovery of the species. Pinnacles biologists continue to work closely with researchers and we will continue to prioritize the collection of samples and data that support scientific research. With funding for research limited, we recommend all condor release sites and recovery partners work together with USFWS leadership to discuss highest priority needs, research proposals, joint funding opportunities, and collaboration on a yearly basis.

Outreach

Outreach efforts continue to be critical to inform the public's perception of non-lead ammunition and understanding of how lead affects all wildlife species. Outreach gives us the opportunity to highlight the importance of a hunter's role in condor recovery and how hunting, as well as ranching, provides forage and habitat for the condor. Outreach is not a short-term effort but builds over many years.

Over time we have seen increased awareness and changing perceptions of this issue on local and nationwide scales. In general, PNP's Wildlife Health Outreach Coordinator has observed less hostility over the issue of non-lead ammunition and has seen greater openness over time. Although attitudes can vary due to current events, the general trend observed has been positive. Our greatest need with outreach continues to be the development of social metrics that accurately track knowledge of and attitudes about the impacts of lead ammunition to wildlife health and conservation, as well as the effect of outreach on peoples' perspectives. While we use informal feedback to address questions and concerns of our audiences, we currently have no formal metric to accurately gauge our success.

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 help us understand and appreciate our audience and partners better. As new partnerships are developed we will increase our capacity for outreach and ability to work toward a positive solution.

We recommend condor recovery release sites and all recovery partners across the western US work together on an outreach program that diverse audiences can understand. Each organization can learn from the successes of others to date and fine tune messages that are most suitable for their audiences. At PNP, we will continue with outreach at multiple scales, including our surrounding community.