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IN THE UNITED STATES DISTRICT COURT

FOR THE DISTRICT OF ARIZONA

PRESCOTT DIVISION

CENTER FOR BIOLOGICAL DIVERSITY; SIERRA CLUB; and GRAND CANYON WILDLANDS COUNCIL, Plaintiffs, vs. UNITED STATES FOREST SERVICE, Defendant.	Case No: 3:12-cv-08176-SMM **RESPONSE IN OPPOSITION TO NRA'S MOTION TO INTERVENE**

COME NOW Plaintiffs Center for Biological Diversity, Sierra Club and Grand Canyon Wildlands Council (collectively "Plaintiffs"), and file this Response in Opposition to the National Rifle Association's and Safari Club International's[1] Motion to Intervene (Doc. No. 28) and supporting documents. Plaintiffs oppose the NRA's motion

[1] The National Rifle Association and Safari Club International are referred to collectively in this Response as the "NRA."

because it has not satisfied all of the requirements for intervention as of right. Specifically, the NRA has not shown that the United States Forest Service ("Defendant" or "Forest Service") will not adequately represent its interests in the liability phase of the litigation. Additionally, because one of the NRA's main objectives—challenging the scientific bases for the widely-accepted and well-established threat spent lead ammunition poses to California condors—will unduly delay the proceedings, permissive intervention in the liability phase should not be allowed. Accordingly, the Court should limit the NRA's participation to the remedy phase of the litigation.

I. Background

In this case brought under the citizen suit provision of the Resource Conservation and Recovery Act ("RCRA"), Plaintiffs seek declaratory relief and to permanently enjoin the Forest Service from contributing to an imminent and substantial endangerment to human health or the environment on the Kaibab National Forest. The endangerment is caused by the disposal of spent lead ammunition on national forest land that is later ingested by wildlife there. The NRA seeks to intervene in this action for the stated purpose of preserving its members' rights to continue to use lead ammunition in the Kaibab National Forest—in other words, to preserve the regulatory status quo.

The risk of poisoning and mortality posed to wildlife by spent lead ammunition is well established.[2] Wildlife species are exposed to spent lead ammunition when they consume mammals that have been shot but not retrieved or when they consume the

[2] *See* National Park Service ("NPS") website, http://www.nps.gov/pinn/naturescience/leadinfo.htm (accessed Jan. 4, 2013) ("More than 500 scientific studies published since 1898 have documented that worldwide, 134 species of wildlife are negatively affected by lead ammunition.").

remains of field-dressed animals (also known as "gut piles") that have been killed with lead ammunition. Complaint, ¶¶ 28-29. Non-lead ammunition—which has been available for years and is already is being used by NRA members (NRA Mot. at 9, n.8)—would prevent the needless deaths of countless wildlife from lead poisoning.

In northern Arizona, the regular lead poisonings and deaths of California condors, the largest flying birds in North America, best illustrate the adverse effects on wildlife of spent lead ammunition in the environment. After dwindling to the brink of extinction in the early 1980s, California condors have rebounded due to a captive breeding program administered primarily by U.S. Fish and Wildlife Service ("FWS"). Captive-bred condors have been reintroduced to areas of their historic range, including the Grand Canyon ecoregion, which includes the Kaibab National Forest. As part of the reintroduction effort, FWS created the Southwest Condor Recovery Team ("SCRT") to study and monitor condors' health and progress toward self-sustainability.[3] The SCRT conducts comprehensive reviews of the program every five years, the most recent of which was released in May 2012 ("2012 Review").[4] *See* Doc. 21, Att. B. The 2007 and 2012 Reviews focused on the issue of lead poisoning from spent ammunition, which is the undisputed primary cause of condor mortality in the southwest population.

The SCRT identified lead poisoning from ammunition sources as a particular threat to condors more than 10 years ago. 2002 Review at 22 ("Considering the number

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[3] The SCRT is comprised of representatives from FWS, the Forest Service, the Bureau of Land Management, the National Park Service, the Arizona Game and Fish Department, the Utah Division of Wildlife Resources, and The Peregrine Fund.

[4] The first Five-Year Review was published on February 14, 2002 ("2002 Review") (attached as Exhibit 1); the second Five-Year Review was published in April 2007 ("2007 Review") (attached as Exhibit 2).

of game animals harvested each year (and associated gut piles left behind) within the current foraging range of the condor, and the number of animals that likely go unrecovered by hunters, there is a *substantial and ongoing risk* of lead poisoning in condors.") (emphasis added). In subsequent reviews, the SCRT has confirmed the existence of this "substantial and ongoing risk" posed by spent lead ammunition in the environment. *See* 2007 Review at 18 ("In summary, shotgun pellets and rifle bullet fragments in animal carcasses have been the primary source of lead contamination to condors in Arizona."); 2012 Review (Doc. 21, Att. B) at 8.

Since their reintroduction to northern Arizona, condors have foraged on the Kaibab Plateau in the Kaibab National Forest. 2002 Review at 12. The Kaibab National Forest is a popular hunting area (NRA Mot. at 6), especially for big game, which is a preferred food source for condors. 2002 Review at 14. The 2007 and 2012 Reviews documented increases in blood lead levels in condors during and after hunting seasons. *See, e.g.*, 2012 Review at 10 (noting "abrupt increase of [condor] blood lead levels has corresponded with increased [condor] use of deer hunting areas on the Kaibab Plateau and southern Utah since 2002"). Although the majority of the evidence involves condors, other species live in the Kaibab National Forest that also are known to have been poisoned by exposure to lead ammunition, including golden and bald eagles. Complaint, ¶ 27.

II. The NRA Has Not Met the Requirements for Intervention as of Right

Applicants to intervene as of right must demonstrate that four requirements are met:

(1) the motion must be timely[5]; (2) the applicant must claim a "significantly

[5] Plaintiffs do not contest the NRA's motion on timeliness grounds.

> protectable" interest relating to the property or transaction which is the subject of the action; (3) the applicant must be so situated that the disposition of the action may as a practical matter impair or impede its ability to protect that interest; and (4) the applicant's interest must be inadequately represented by the parties to the action.

California ex rel. Lockyer, 450 F.3d 436, 440 (9th Cir. 2006). "The party seeking to intervene bears the burden of showing that *all* the requirements for intervention have been met." *United States v. Alisal Water Corp.*, 370 F.3d 915, 919 (9th Cir. 2004) (emphasis in original). Courts "are guided primarily by practical and equitable considerations" and "generally interpret [intervention] requirements broadly in favor of intervention." *Donnelly v. Glickman*, 159 F.3d 405, 409 (9th Cir. 1998).

Nonetheless, courts retain broad discretion in determining when and how applicants for intervention may participate in the litigation. *See* Advisory Committee Notes on Fed. R. Civ. P. 24 (intervention "may be subject to appropriate conditions or restrictions responsive among other things to the requirements of efficient conduct of the proceedings"); *see also Donnelly*, 159 F.3d at 409-10 (examining appropriateness of intervention separately for liability and remedial phases of case). Accordingly, this Court should analyze the intervention factors in relation to the phase of the case purportedly implicated by the NRA's articulated interests.[6] *See, e.g., id.*

A. The NRA Has Failed to Show That Its Interests Will Be Inadequately Represented by the Forest Service During the Liability Phase of the Case

An applicant for intervention bears the burden of demonstrating existing parties

[6] To the extent the NRA argues that *Sagebrush Rebellion, Inc. v. Watt*, 713 F.2d 525 (9th Cir. 1983), prohibits limiting intervention to the remedial phase only, the Ninth Circuit explicitly foreclosed that argument in a later-decided case. *See Donnelly*, 159 F.3d at 410, n.4.

will not adequately represent its interests. A presumption of adequate representation exists when "an applicant for intervention and an existing party have the same *ultimate* objective." *Nw. Forest Res. Council v. Glickman*, 82 F.3d 825, 838 (9th Cir. 1996) (emphasis added). Because the NRA and the Forest Service share the same "ultimate" objective—regulatory status quo for the Kaibab National Forest—this Court should presume the Forest Service adequately represents the NRA's interests at the liability phase. In light of this presumption, the NRA must make a "compelling showing" to demonstrate inadequate representation. *Id*. It has not done so.

The NRA argues that no presumption should apply because the NRA and the Forest Service "have different objectives." NRA Mot. at 13. But this is merely an attempt to parse the language of its "objectives" to manufacture a difference with the Forest Service. The Forest Service's "ultimate" objective of preserving the regulatory status quo for the Kaibab National Forest means, in the NRA's words, "avoiding a finding of liability against it under RCRA and preserving its ability to continue to regulate uses of its lands without potential RCRA liability." NRA Mot. at 13; *see also* Def. Mot. to Dismiss (Doc. 46) at 12-16. For the NRA, regulatory status quo means "preserving their members' ability to continue to use lead ammunition" for hunting in the Kaibab National Forest. *Id*. The Forest Service's success in achieving its "ultimate" objective necessarily achieves the NRA's "ultimate" objective. "Where parties share the same ultimate objective, differences in litigation strategy do not normally justify intervention." *Arakaki v. Cayetano*, 324 F.3d 1078, 1086 (9th Cir. 2003).

In light of the presumed adequacy of representation, the NRA has not made a compelling showing that the representation by the Forest Service at the liability phase is inadequate.[7] Even beyond the applicability of a presumption, the NRA has not made the "minimal" showing necessary to meet its burden of establishing inadequacy of representation at the liability phase. The Ninth Circuit considers three factors: "(1) whether the interest of a present party is such that it will undoubtedly make all the intervenor's arguments; (2) whether the present party is capable and willing to make such arguments; and (3) whether the would-be intervenor would offer any necessary elements to the proceedings that other parties would neglect." *Arakaki*, 324 F.3d at 1086. None of the three factors weighs in favor of NRA intervention at the liability phase.

1. The Only Argument NRA Has Identified that the Forest Service is Unlikely to Make on Liability Is Meritless

The NRA attempts to identify a facet of the litigation for which its objectives diverge with the Defendant's at the liability stage. Specifically, the NRA articulates its additional objectives as:

> obtaining a ruling indicating that the normal use of lead ammunition in the Kaibab NF does not create: (1) an "imminent and substantial endangerment to health or the environment" under RCRA, and (2) a legal basis to limit lead ammunition use because of alleged health concerns related to members of the experimental population of condors released in Arizona.

NRA Mot. at 13. The NRA claims that the Forest Service's representation of its interests will be inadequate because "the Service has apparently adopted CBD Plaintiffs' theory

[7] The NRA also makes a passing reference to the language in 42 U.S.C. § 6972(b)(2)(E), suggesting that it supplants any otherwise applicable presumption of adequacy of representation. The NRA cites to no authority, however, nor are Plaintiffs aware of any, that suggests this provision renders inapplicable the body of case law discussed herein. Moreover, the NRA's reading of the statute is strained, to say the least. The provision by its terms applies only to the EPA Administrator and the State, neither of which is a party to this case. Indeed, the legislative history of this provision makes clear that Congress included it to ensure members of the public who live near an endangerment would be able to intervene in a state or EPA-initiated action. *See* S. Rep. No. 98-284, at 15 (1983). Obviously, that is not the posture of this case.

that hunter-shot lead ammunition is the main threat to condor survival."[8] *Id*. at 15. The NRA then knocks down its straw man objectives, claiming, "it is doubtful the Service will make NRA and SCI's arguments that run contrary to that theory."[9] *Id*.

While the NRA likely correctly assumes that "the Service will not challenge [Plaintiffs'] proffered evidence and basic underlying theory that hunter-shot lead projectiles pose a particular threat to condors" and other wildlife (NRA Mot. at 14), there is good reason for this. The government has consistently taken that position for more than a decade, and overwhelming evidence demonstrates the imminent risk spent lead ammunition poses to wildlife, and specifically to condors in the Kaibab National Forest since their reintroduction there 15 years ago. The scientific evidence of endangerment, including years of data from tracking and measuring blood lead levels of condors in Arizona, is more than sufficient to meet the relatively low threshold to show the disposal of spent lead ammunition in the Kaibab National Forest "may present" an imminent and substantial endangerment under RCRA § 6972(a)(1)(B).

Accordingly, the fact that the Forest Service likely will not challenge Plaintiffs' proffered endangerment evidence—most of which has been generated by the federal government itself in support of the condor reintroduction program—is not a factor

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[8] This statement is misleading insofar as the federal government (and the State of Arizona for that matter) has long believed that exposure to spent lead ammunition in the environment is the main threat to condor survival. *See infra*, at 11-13. Plaintiffs have adopted the federal government's theory in that regard—not the other way around.

[9] In *Southwest Center for Biological Diversity v. Berg*, the Ninth Circuit overturned a district court denial of intervention stating that it was not the applicant's burden "to anticipate specific differences in trial strategy." *Sw. Ctr. for Bio. Div. v. Berg*, 268 F.3d 810, 824 (9th Cir. 2001). Here, however, the NRA *has* identified the one different argument it intends to make that the Defendant likely will not, but, as explained below, that argument is without merit.

weighing *in favor* of NRA intervention. To the contrary, it is a factor weighing *against* NRA intervention in the liability phase of the case. There is no requirement—nor should there be—that present parties to the litigation "will undoubtedly make all the interveners' arguments," no matter how meritless. Similarly, Defendant is certainly *capable* of making the argument the NRA suggests, but the fact that it may be *unwilling* to do so speaks more to weakness of the argument than it does to the adequacy of representation at the liability phase. Rule 24 analysis "is guided primarily by *practical and equitable considerations*." *Donnelly*, 159 F.3d at 409 (emphasis added). The overriding practical consideration in this instance is the time and resources the Court and the parties will spend litigating an issue that no one—not the Forest Service, not the state of Arizona, not the SCRT—*other than the NRA* disputes.

Accordingly, in order to achieve its "objectives," the NRA must overcome, as described in detail below, a legal endangerment standard that Congress intended to err on the side of protecting health and the environment, as well as overwhelming and objective scientific evidence. Because the NRA's likelihood of success in prevailing in this regard is extremely low, allowing it to intervene in the liability phase cuts against the "practical considerations" that guide the intervention analysis.

a. Plaintiffs Must Show Only that the Waste at Issue *May Present* an Imminent and Substantial Endangerment

While the NRA intends to argue "that the best scientific evidence available does not sufficiently establish a nexus between condor illness and hunters' use of lead ammunition" (NRA Mot. at 14), the NRA's motion fails to discuss the well-established legal standard for the "imminent and substantial endangerment" element of Plaintiffs'

RCRA § 6972(a)(1)(B) claim—a critical factor in the overall evaluation of whether intervention is appropriate. The Ninth Circuit—and every other circuit that has analyzed this element of RCRA § 6972(a)(1)(B) claims—has concluded, "a finding that an activity may present an imminent and substantial harm does not require actual harm." *Price v. U.S. Navy*, 39 F.3d 1011, 1019 (9th Cir. 1994) (citing cases); *see also Dague v. City of Burlington*, 935 F.2d 1343, 1355(2d Cir. 1991) (finding Congress' use of the word "may" intended "to confer upon the courts the authority to grant affirmative equitable relief to the extent necessary to eliminate *any risk* posed by toxic wastes.") (emphasis in original), *rev'd in part on other grounds*, 505 U.S. 557 (1992).

When courts have found that plaintiffs have not met their burden to show that the waste at issue "may present" an imminent and substantial endangerment, unlike the facts Plaintiffs allege here, those plaintiffs showed absolutely no nexus or pathway connecting the waste to the potential exposure. For example, the Ninth Circuit in *Price* found no endangerment existed where a concrete foundation covered any possible contamination and any cracks in the concrete could be repaired without disturbing the foundation and underlying soil. *Price*, 39 F.3d at 1020-21. In other words, there was no possible exposure pathway and no "necessity for action." *Id.* at 1019.

The NRA does not even suggest it can establish that there is no potential exposure pathway between spent lead ammunition in the environment and harm to wildlife. In fact, its motion implicitly acknowledges this nexus exists when it states the NRA "has found evidence that suggests that lead poisoning may not be *the leading cause of death* of condors released in Arizona." NRA Mot. at 15 (emphasis added). Even if the NRA could prove (and it cannot) that lead poisoning is not be the "leading cause of death of condors," that would not successfully rebut Plaintiffs' evidence that spent lead ammunition "may present" an imminent and substantial endangerment to condors and other wildlife.

b. Overwhelming Evidence Will Show That Spent Lead Ammunition *May Present* an Imminent and Substantial Endangerment to Condors and Other Wildlife in the Kaibab National Forest

When viewed in the context of RCRA's endangerment standard, it is clear that the best available evidence will be more than sufficient to satisfy the standard. The scientific evidence catalogued below and that the Plaintiffs would present if necessary was generated independently as part of the condor recovery program, not on behalf of the Plaintiffs' position in this litigation. Moreover, Plaintiffs are unaware of any peer-reviewed scientific articles or opinions disputing the existence of the spent lead ammunition threat to condors in the Kaibab National Forest.

As discussed above, the 2012 Review by the SCRT concluded, "the most significant issue raised in the second program review [in 2007], exposure to lead contamination, continues to affect both individual birds and the southwest population." 2012 Review at 4. The 2012 Review confirmed the conclusion of the 2007 Review that "[l]ead poisoning has been by far the leading cause of condor fatalities since reintroduction in 1996." *Id*. at 15. In addition, 63% of wild condors tested in 2011 were found to have blood lead levels indicative of lead exposure. *Id*. at 19. The SCRT determined that 18% of the condors tested in 2011 had toxic blood lead levels. *Id*. The recognized primary sources of lead contamination to condors in Arizona are "shotgun pellets and rifle bullet fragments in animal carcasses." *Id*. at 18.

Further, SCRT data linked blood lead levels in condors to hunting on the Kaibab Plateau. *Id.*; *see also* 2012 Report at 13 ("Like the previous five years of the condor release program in Arizona, lead poisoning cases occur predominantly in the fall and winter months and are associated with the big-game hunting seasons.").

Not surprisingly, the SCRT's conclusion that lead poisoning from spent ammunition is the leading threat to condors is widely shared among all agencies of the federal government. The U.S. Department of the Interior recognizes the fact that lead poisoning poses a serious threat to condors:

> *scientific studies have reached a consensus*: lead poisoning is the biggest threat facing the successful recovery of the California condor. . . . [L]ead poisoning through ingestion of spent lead bullets and shell shot has been demonstrated as being a serious factor for many other wildlife species too, including our national symbol the bald eagle . . . golden eagles, hawks, ravens, turkey vultures, and grizzly bears.[10]

The Bureau of Land Management ("BLM") warns hunters "[w]hen condors, eagles, vultures, and ravens feed on carrion which contains lead bullet fragments, their digestive tract [sic] stops functioning and the birds die a slow agonizing death."[11]

In 2010, a Blue Ribbon Panel of experts assembled by the American Ornithologists' Union to conduct a comprehensive review of the California condor reintroduction program concluded:

> Although the significance and source of lead exposure in reintroduced condors were debated just a few years ago, *there is now widespread consensus and considerable evidence* that poisoning from ingestion of lead ammunition fragments in carcasses currently precludes the establishment of

[10] NPS website, http://www.nps.gov/pinn/naturescience/leadinfo.htm (accessed Jan. 4, 2013) (emphasis added).
[11] BLM Website, http://www.blm.gov/ca/st/en/fo/bakersfield/Programs/carrizo/hunting.html (accessed Jan. 4, 2013).

viable populations in the wild.[12]

Thus, in the past three years, significant new scientific data has been added to the already robust collection of evidence demonstrating the risk to wildlife posed by spent lead ammunition in the environment.[13]

The State of Arizona concurs that lead toxicity is the leading cause of mortality for condors in Arizona: "Lead toxicity has been identified as the leading cause of death in condors in the Arizona reintroduction program. . . . Biologists have documented over 300 instances of lead exposure in condors since testing began in 1999, with 45 to 95 percent of the condor population testing positive for lead exposure each year."[14] Further, the source of lead exposure is clear to the state: spent lead ammunition from hunting. *Id*.

2. The NRA Offers No Elements Necessary to the Proceedings

The NRA offers little by way of explanation of what necessary elements it would add to the liability phase. The NRA claims to have "compiled and analyzed relevant scientific data and related material to effectively define the scientific deficiencies that

[12] Walters, J. et al., Status of the California Condor (*Gymnogyps Californianus*) and Recovery Efforts to Achieve Its Recovery, in The Auk 127(4):969-1001 (2010), at 974 ("Blue Ribbon Panel Study") (internal citations omitted) (attached as Exhibit 3).

[13] For this reason, the NRA's intervention in the prior case in Arizona against the BLM to contest the same science is distinguishable. In that case, the NRA sought intervention "to argue that the administrative record and the relevant scientific data do not support CBD's assertion regarding the prevalence of lead-related condor mortalities." *See Center for Biological Diversity v. Bureau of Land Mgmt.*, Case No. 3:09-cv-08011-PCT-PGR (D. Ariz.), Doc. 58, at 8-9 (Jan. 30, 2010). Since that opinion issued on January 30, 2010, in addition to substantial evidence contained in the 2012 SCRT report, the independent Blue Ribbon Panel concluded "[a]lternative views about the threat posed by lead and sources of lead exposure, which were plausible only a few years ago, are no longer credible." Blue Ribbon Panel Study at 974. The other two cases cited by the NRA in which it sought and obtained permission to intervene (NRA Mot. at 3, n.2) involve issues and potential regulatory changes that are much broader than the discrete endangerment alleged here.

[14] *See* http://www.azgfd.gov/w_c/california_condor_lead.shtml (accessed Jan. 4, 2013).

underlay the contested conclusion that condors are dying from the ingestion of hunter-shot lead." Of course, as described above, Plaintiffs' RCRA claim does not require actual harm (although all of the evidence supports actual harm is occurring). So even assuming such material exists and is being accurately portrayed by the NRA as contesting the conclusion that "*condors are dying*"—which Plaintiffs do not concede—that would not undermine Plaintiffs' claim that spent lead ammunition in the environment "may present" an imminent and substantial endangerment.

Finally, the NRA's contention that it is "unaware of the Service having this particular expertise" (NRA Mot. at 16) is absurd. As shown above, the federal government, due to its work in reintroducing condors to northern Arizona and oversight of and participation in the ongoing activities of the SCRT since 1996, has acquired significant and "particular expertise" regarding the threats facing condors in Arizona.

B. The NRA's Articulated Interests and Purported Impairment Thereof Are Overstated, But in Any Event Are Protectable at the Remedy Phase of Litigation

The NRA asserts it has interests in (1) their members' continued ability to hunt with lead ammunition in the Kaibab National Forest; (2) their organizations' ability to carry out their missions "to preserve the tradition of hunting, and to protect it from unreasonable and unnecessary restrictions"; and (3) protecting and preserving the rights of hunters to continue to enjoy areas that have traditionally been open to hunting." NRA Mot. at 9-10. All of these interests, and those discussed in the substance of the declarations filed in support of the NRA's motion, are implicated, if at all, during the remedy phase of the litigation.

As an initial matter, any restrictions on hunting with lead ammunition on the

Kaibab National Forest in order to prevent lead poisonings and deaths of condors and other wildlife would be neither "unreasonable" nor "unnecessary." Similar restrictions on the use of lead ammunition have become commonplace around the country both on the state and federal level. *See, e.g.*, California's Ridley-Tree Condor Preservation Act, AB 821 (2007) (prohibiting the use of lead ammunition in condor range); 75 Fed. Reg. 75153-01 (December 2, 2010) (FWS's final rule requiring that non-lead shot or bullets be used in most cases when depredating certain bird species).

The trend toward limiting or prohibiting the use of lead ammunition when and where its use poses a threat to wildlife is clear. And, as discussed in detail above, the threat posed to condors by the use of lead ammunition in the Kaibab National Forest is beyond dispute. The best available science has concluded it is *necessary* to address the prevalence of spent lead ammunition in the environment in order to prevent future condor poisonings and deaths due to lead toxicosis.

Additionally, if Plaintiffs prevail on liability, and if the use of lead ammunition for hunting is prohibited or otherwise restricted in the Kaibab National Forest, such a ruling absolutely would not prevent NRA members from continuing to hunt there. NRA members would enjoy the same access to the Kaibab National Forest that existed prior to any potential lead ammunition restrictions. Hunters would be able to hunt, *inter alia*, in the same areas, for the same species and numbers of game, and at the same times of year. And although the NRA claims that Plaintiffs seek a remedy that "conflicts with federal law intended to protect hunting" (NRA Mot. at 4), the law it cites—50 C.F.R. § 17.84(j)(2)(i)—does not say what the NRA says it does. That regulation exempts from the general prohibition of taking California condors in the experimental population area, the "unavoidabl[e] and unintentional[] take" of condors so long as such take is "non-negligent and incidental to a lawful activity, such as hunting." 50 C.F.R. § 17.84(j)(2)(i). Accordingly, to the extent this regulation applies at all to this RCRA case, rather than protecting hunting, it *prohibits* hunting that results in *avoidable* harm to condors. The NRA's admission that its members already hunt with non-lead ammunition establishes that the harm to condors from exposure to spent lead ammunition is easily avoidable.

To the extent that some NRA members will be inconvenienced by having to switch to non-lead ammunition to continue to hunt in the Kaibab National Forest, the NRA can adequately represent those interests in the remedy phase of the litigation. The NRA may present evidence supporting, for example, its contention that "ammunition regulations excluding the use of lead ammunition would *preclude* the hunting of [small game and turkey] in the Kaibab NF by hunters who cannot afford or locate non-lead ammunition." NRA Mot. at 12 (emphasis added). Plaintiffs would be prepared at that point to present counter evidence.[15] At the remedy stage, therefore, this Court can weigh the purported inconvenience of some NRA members' having to switch to non-lead ammunition to hunt in a discrete geographic area in northern Arizona against the efficiency and effectiveness of imposing such restrictions in order to abate the endangerment to wildlife caused by the continued use of lead ammunition.

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[15] *See, e.g.*, http://www.azgfd.net/hunting/small-game-hunting/attention-varmint-and-small-game-hunters-new-non-lead-ammunition-available-this-year/2009/03/18/ (accessed Jan. 4, 2013) (blog post from Arizona's Department of Game and Fish's website from nearly four years ago describing increased availability of varmit and small game non-lead ammunition).

III. Permissive Intervention is Unwarranted and Should Be Denied

The NRA's request for permissive intervention should be denied because its participation in the liability phase of the case will "unduly delay [and] prejudice the adjudication of the original parties' rights." Fed. R. Civ. P. 24(b)(3). As discussed above, the NRA has not shown inadequate representation in the liability phase on the part of the Forest Service for its ultimate objective, and the NRA's intervention to pursue its other objectives will result in needless delay. *See Tripp v. Executive Office of the President*, 194 F.R.D. 344, 348 (D.D.C. 2000) (denial of permissive intervention justified by same considerations justifying denial of intervention of right, and because permissive intervention would unreasonably frustrate the case). In cases seeking to enforce environmental laws in the public interest, delays due to intervention are especially prejudicial to parties and the public because they can stall the resolution of important environmental issues. *See Cronin v. Browner*, 898 F. Supp. 1052, 1063 (S.D.N.Y. 1995).

IV. Conclusion

For the foregoing reasons, if the Court is inclined to grant the NRA's motion to intervene, Plaintiffs respectfully request the Court limit the NRA's participation to the remedy phase of this litigation.

Respectfully submitted,

Dated: January 4, 2013

/s/ Kevin Cassidy
Kevin M. Cassidy

CERTIFICATE OF SERVICE

I hereby certify that on January 4, 2013, I electronically transmitted the attached document to the Clerk's Office using the CM/ECF System for filing and transmittal of a Notice of Electronic Filing, which will send notification of such filing to the following:

Dustin Maghamfar, United States Department of Justice, Attorney for Defendant United States Forest Service.

James Odenkirk, Attorney for the State of Arizona.

Adam Keats, Attorney for Plaintiffs.

Anna Margo Seidman, Carl Dawson Michel, Douglas Scott Burdin, and Scott M. Franklin, Attorneys for Proposed Interveners.

/s/ *Kevin Cassidy*

EXHIBIT 1

A Review of the First Five Years of the California Condor Reintroduction Program in Northern Arizona

Reintroduced California Condor Soaring Over the Grand Canyon
Photo by: Chris Parish

14 February 2002
(27 February 2002, Printing)

A Review of the First Five Years of the California Condor Reintroduction Program in Northern Arizona

List of Preparers

This report is prepared for the California Condor Recovery Team and U.S. Fish and Wildlife Service, California/Nevada Operations Office, Sacramento, California, in fulfillment of the requirements of the Federal-rule (61 FR 54044-54059) allowing for the reintroduction of California condors under an nonessential experimental designation in northern Arizona and southern Utah.

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A Review of the First Five Years of the California Condor Reintroduction Program in Northern Arizona

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INTRODUCTION

The U.S. Fish and Wildlife Service (FWS) is now completing the fifth year of releases of California condors (*Gymnogyps californianus*) in northern Arizona. This reintroduction was conducted under a special provision of the Endangered Species Act (ESA) that allows for the designation of a "nonessential experimental" population. Under this designation (often referred to as the "10(j) rule" or "10(j) area" for the section of the ESA allowing this provision) the protections for an endangered species are relaxed, providing greater flexibility for management of a reintroduction program. As part of the Federal rule-making process that established the nonessential experimental designation (61 Federal Register 54044-54059; 16 October 1996), the FWS agreed to a formal evaluation of the progress and public acceptance of this reintroduction within the first five years of the program. In addition to the final rule establishing the nonessential experimental designation, FWS entered into a "Memorandum of Understanding" (MOU) with various cooperators, including state and federal agencies, Native American nations, and private organizations, and an "Implementation Agreement with Local Governments." These documents outlined commitments by FWS and cooperators in the implementation of the condor reintroduction program, and the application of federal regulation. This report evaluated the progress of the condor reintroduction program in northern Arizona and compliance with commitments established for this program.

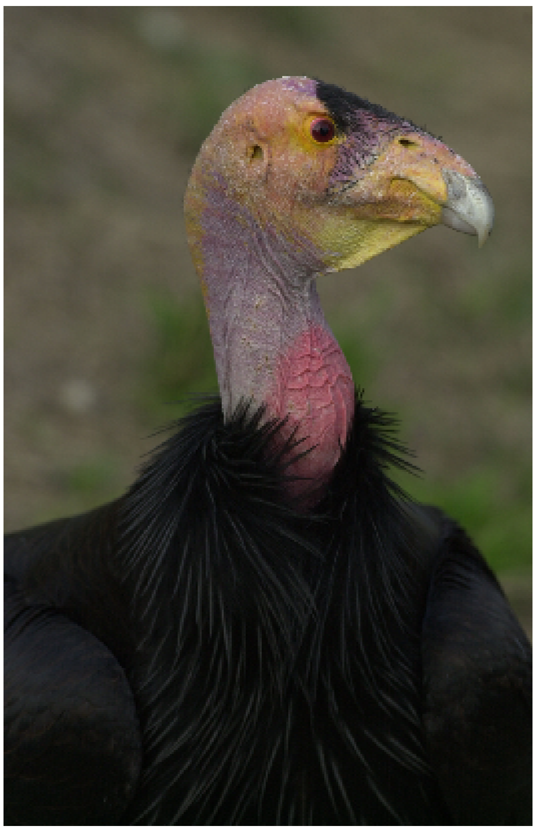

Figure 1. Portrait of an adult California condor. Photo by: Scott Frier.

BACKGROUND

The program of releasing California condors in northern Arizona (for the purposes of this report, unless otherwise indicated, reference to "northern Arizona" also includes condor activities in southern Utah) has been entered into by the FWS as a partnership among various federal agencies (primarily: Bureau of Land Management [BLM]; National Park Service [NPS]; U.S. Forest Service [USFS]) and state agencies (primarily: Arizona Game and Fish Department [AGFD]), and The Peregrine Fund, a private/nonprofit organization. The Peregrine Fund manages the day-to-day operations of the field program, including release, monitoring the birds' movements, working with local land owners and land managers, and providing any additional care for the birds. The Peregrine Fund also maintains a condor breeding facility at the World Center for Birds of Prey in Boise, Idaho. Representatives of these agencies and organizations, together with others identified in the interagency MOU, form the "Arizona Condor Working Group," facilitating coordination among the agencies and organizations.

The first condor release occurred on 12 December 1996, and through January 2002, 47 condors have been released to the wild in northern Arizona from nine release events. Reintroduction efforts have been complicated by predation, lead poisonings, bird-human interactions, and a shooting; 18 birds have died and 4 have been returned to captivity due to behavioral concerns (two of which may be re-released at some time in the future). After five years of the release program, there are 25 free-flying condors in northern Arizona, and eleven additional birds held since November 2001 in the flight pen in anticipation of a release early in 2002. In March 2001, a reintroduced bird produced the first confirmed condor egg laid in the wild since 1986. The egg was laid in a shallow cave in Grand Canyon National Park.

The nonessential experimental population status applies to condors only when they are within the geographic bounds of the designation in northern Arizona and southern Utah, which is defined by: Interstate Highway 40 on the south, U.S. Highway 191 on the east (parallel to the New Mexico and Colorado state borders), Interstate Highway 70 in central Utah on the north, and Interstate Highway 15 to U.S. Highway 93 near Las Vegas Nevada on the west (61 FR 54044). When condors leave this area they receive full protection of the ESA, which may have regulatory implications. The condors have been known to fly widely, but generally remain within the Grand Canyon Ecoregion/Colorado River corridor. However, condors have left the nonessential experimental area on several occasions, flying as far as Flaming Gorge, Wyoming, 310 miles from the release site. All of the far-wandering condors returned to the release area on their own, usually within a few days. For detailed information on the chronology of the condor reintroduction program in northern Arizona see Appendices A and B.

REVIEW PROCESS

This review was conducted by a team (referred to within this report as the review team, and as listed on page i) that included condor biologists, representatives of local land and wildlife management agencies, and FWS, with input from local governments and the public. This report, prepared by the review team, is submitted to the California Condor Recovery Team, an advisory panel of scientists providing oversight of the California Condor Recovery Program for FWS. The Recovery Team reviews and forwards the report and their recommendations to the FWS California/Nevada Operations Manager (Sacramento, California). The FWS is responsible for making the final decision regarding the continuation of this reintroduction program and adoption of recommendations. This process fulfills the five-year review requirement as stated in the final rule establishing the nonessential experimental population of California condors in northern Arizona.

The guidelines under which the review was conducted comes from the final rule establishing the nonessential experimental designation:

> Final Rule, Endangered Species Act, Section 10(j) (61 FR 54044-54059). Special Rule 10, p. 54058. *(10) The status of the reintroduction project is to receive an informal review on an annual basis and a formal evaluation within the first 5 years after the initial release, and every 5 years thereafter. This evaluation will include, but not be limited to: a review of management issues; compliance with agreements; assessment of available carrion; dependence of older condors on supplemental food sources; post release behavior; causes and rates of mortality; alternative release sites; project costs; public acceptance; and accomplishment of recovery tasks prescribed in California Condor Recovery Plan. The number of variables that could affect this reintroduction project makes it difficult to develop criteria for success or failure after 5 years. However, if after 5 years the project is experiencing a 40 percent or greater mortality rate or released condors are not finding food on their own, serious consideration will be given to terminating the project.*

The review guidance from the final rule basically poses two questions: 1) have condors been provided a reasonable opportunity for survival, and not put at too great a risk due to either ecological factors or a lack of protections of the ESA under the nonessential experimental designation? and 2) did the FWS and other agencies comply with their various commitments regarding the application/relaxation of federal regulation?

This report examined each of the major issues brought forward from comments from the public or identified by review team members, in the context of the review guidelines from the final rule. In addition, issues addressed in the final rule were re-assessed. Each topic was individually addressed, and grouped in one of two categories: biology and management, or administration. Recommendations to improve the effectiveness of the program were included.

PUBLIC PARTICIPATION

The review team met on 20 September 2001, to develop a framework for the evaluation process. To fully evaluate all aspects of the condor reintroduction program in northern Arizona and southern Utah, the review team sought the comments and participation of local affected individuals, governments, Tribes, agencies, business owners, and organizations; environmental and industry groups; and condor and endangered species experts. The public was notified of the review process, responses to specific questions were solicited from targeted groups, telephone interviews and meetings with affected/interested parties and experts were conducted, and input was accepted through electronic and traditional mail.

Two public open houses were hosted, first in Kanab, Utah, on Thursday, 1 November 2001 (7 - 9 p.m. at the Shilo Inn, 296 West 100 North) and then in Flagstaff, Arizona, on Monday, 5 November 2001 (7 - 9 p.m. at the Arizona Game and Fish Department Office, 3500 South Lake Mary Road). These meetings included presentations reviewing the reintroduction experiment in northern Arizona and discussions on various aspects of the program. Eight attendees registered at the Kanab meeting and five registered at the Flagstaff meeting. A summary of comments and discussion from each open house is provided in Appendix C.

Comments were requested through direct mailings, a four state distribution of a news release (and three known resultant news articles in Flagstaff, Arizona, and St. George and Kanab, Utah, newspapers), radio news network contacts, a website posting, and a national California condor recovery electronic mail listserve. Additionally, review team members offered to meet with and brief area agencies, land management advisory groups, county/local government groups, and some tribes. Deadline for submitting comments was 23 November 2001, and then extended through 7 December 2001.

Comment letters were received from a county (3), a state agency (1), federal agencies (4), utility company (1), private citizens (2), and conservation organization (1). All letters expressed optimism for the continued success of the program and each provided responses to questions posed by the evaluation team, suggestions for improving the program, and some requested topics to be included in the review process. Generally, respondents innumerated how they had contributed to the program, met their commitments under various agreements and understandings, and discussed local perception or acceptance of the program, condor management considerations, and how condor management had or had not affected land use in the area. Some stated various reasons requesting an expansion of the nonessential experimental area. Appendix C includes a summary list of issues raised by commenters. Written comment letters and the list of attendees at each public open house are included in the administrative record for this review and is available upon request from the Arizona Ecological Services Office, 2321 W. Royal Palm Road, Suite 103, Phoenix, Arizona, 85021, Phone: (602) 242-0210.

The review team met 11-13 December 2001, to review all comments received, to determine additional information needs and sources, and to outline the content of this review. The team met again on 29 January 2002. All written and oral comments are addressed within the body of this review.

BIOLOGY and MANAGEMENT

Release Strategies

Figure 2. Vermilion Cliffs, the primary release area for the reintroduction of California condors in northern Arizona. Photo by: Bruce Palmer.

California condors were first reintroducted in northern Arizona on 12 December 1996, when six birds were released from the western end of the Vermilion Cliffs on BLM administered land. The Vermilion Cliffs release site on the Paria Plateau has been the primary condor holding site and release area (Figure 2). Of the nine total condor release events between December 1996 and December 2000, seven have been at Vermilion Cliffs, where 31 condors have been released. Reintroductions generally involved transporting five- and six-month old (fledging age) captive produced condors to the release site where they were held in an acclimation pen (dimensions of the flight pen are 40 x 20 x 5.5 feet, and an adjacent 40 x 8 x 5 feet semi-enclosed box structure for protection from the elements). A mock power pole fitted with a low voltage electrified crossarm was placed near the acclimation pen (and later when the flight pen was enlarged moved inside the pen) for adverse conditioning of condors to teach them to avoid perching on power poles (Figure 3). The condors would spend a week- to sometimes a month- in the acclimation pen prior to release. Food was provided to birds while in captivity and supplemental food was provided after release. There were also two releases of a total of nine two year old birds in May of 1997.

Figure 3. Enlarged condor flight pen at Vermilion Cliffs with mock power pole. Photo by: Bruce Palmer.

By the fourth release, in November 1997 (of 4 birds), biologists noticed increased visitation to the acclimation pen/feeding area by the free-flying flock which took full advantage of the supplemental feedings provided for recently released condors. This made it increasingly difficult to ensure that the young birds were obtaining enough food. Not wanting to encourage now-wild condors to loiter around human built structures (i.e., acclimation pen), the caged juvenile condors, and/or the carcasses within the pens, it was decided to establish a second release site.

The goal of establishing a second release site was to create two groups of free-flying condors, each with their own activity center, in order to reduce competition among condors at releases and protect against loss of the entire population to mass mortality (e.g., disease or poisoning). The Hurricane Cliffs release site, approximately 65 miles west of the Vermilion Cliffs, was established in the fall of 1998. This release site is also on BLM administered land. An acclimation pen similar to that at the Vermilion Cliffs was constructed.

Releases occurred at the Hurricane Cliffs site in the winters of 1998 (9 birds) and 1999 (7 birds) in much the same way as had been done at Vermilion Cliffs. The 1998 release cohort found their way to the South Rim of the Grand Canyon, finding condors previously released at Vermilion Cliffs. They then followed the older birds back to Vermilion Cliffs and joined with that group of birds. The following year's release at Hurricane Cliffs proved to be very problematic. Several juvenile condors, without the benefit of older and more experienced free-flying "mentor" birds, demonstrated various behavioral problems including approaching people. The Hurricane Cliffs site was last used for condor releases in 1999. However, a few of the free-flying condors still frequent the Hurricane Cliffs corridor.

Four of the eight condors released at Vermilion Cliffs on 29 December 2000, demonstrated improved behavior patterns over condors released in past years, being more wary of humans and requiring less intervention (e.g., flushing from undesirable locations) by field biologists. They also ranged less widely than young birds in previous years, returning to the release/feeding site every two to four days where they usually took advantage of the regular supplemental feedings.

With approval from FWS and the California Condor Recovery Team, experimental releases of adult condor pairs were conducted at Vermilion Cliffs in December 2000. The condor pairs consisted of two nine-year-old (condor #74 and #82), and two ten-year-old (condor #60 and #70) birds from the World Center for Birds of Prey breeding facility. Both pairs had copulated and produced infertile eggs in captivity. The intent was to release the pairs just prior to the breeding season, with the hope that one or both pairs would breed in the wild. The previous release of two-year-old condors had been successful, and it was hoped that the nine- and ten-year-old birds would acclimate to the wild in a short time. The first pair was released after several weeks in the holding pen; the second pair was released soon after. Almost two weeks following release, the female from the first pair was killed by coyotes in House Rock Valley just over a mile from the release site. Three days later, the male of that pair was found dead, presumably killed by coyotes. Within the next two days, biologists recaptured the second pair after observing that these birds were also roosting on the ground (Figure 4). This pair was returned to the captive breeding program, as it seems their survival skills for the wild had not developed due to being in captivity their entire lives.

Figure 4. Condor #70 captured by Chris Parish for return to captivity due to inappropriate roosting behavior, 29 Dec 2000. Photo by: Bruce Palmer.

During the first five years of the condor reintroduction program in northern Arizona, there have been nine separate releases for a total of 47 condors, 31 at the Vermilion Cliffs and 16 at the Hurricane Cliffs. Of these, 25 are free-flying as of 31 January 2002; 18 have died; and 4 have been returned to captivity (Table 1; Appendix B).

Table 1. Summary of California condor releases in northern Arizona.

Release Date	Location	Number of Condors Released	Status of Condors as of 31 Jan 2002		
			Dead	Captivity	Wild
12 Dec 1996	Vermilion Cliffs	6	3		3
14 May 1997	Vermilion Cliffs	4	2		2
26 May 1997	Vermilion Cliffs	5	1		4
20 Nov 1997	Vermilion Cliffs	4	2		2
18 Nov 1998	Hurricane Cliffs	9	4		5
7 Dec 1999	Hurricane Cliffs	7	3	1*	3
7 Dec 2000	Vermilion Cliffs	2 (adult pair)	2		
19 Dec 2000	Vermilion Cliffs	2 (adult pair)		2	
29 Dec 2000	Vermilion Cliffs	8	1	1	6
	Totals	**47**	**18**	**4**	**25**

* Transferred to Vermilion Cliffs holding pen in November 2001 with 10 juvenile condors in anticipation of a release early in 2002.

Incorporating ideas and experience from condor reintroduction experiments at both California and Arizona release sites, several changes in holding and release strategies have been made since the end of 1999, including:

1. Releases have taken place at the Vermilion Cliffs site in the presence of free-flying condors.

2. Prior to release, juveniles are held in a substantially larger flight pen (40 x 60 x 14 feet). Higher perches were installed in the large flight pen to encourage young condors to select appropriate perches off of the ground to avoid predators after release. A mock power pole for adverse conditioning was moved inside the flight pen. For the December 2000 release, adult condors were also held in the flight pen with the juveniles which may have facilitated the young birds' integration into the condor flock.

3. The condors were held longer in the flight pen before being transported to the release pen situated on the edge of the Vermilion Cliffs, allowing more time for physical and behavioral development, and being able to observe and interact with the free-flying birds.

4. Supplemental food was placed at the release site every three to four days throughout the year, maintaining a constant, contaminant-free food supply.

5. With a large holding pen, sick or problem birds could be recaptured or held back for extended periods in the holding pen, providing a new facet to the management of the flock. Recapturing and holding problem birds removes poor examples from which other birds may learn.

Although crowding does not yet appear to be a problem at the Vermilion Cliffs site, additional release and feeding sites will likely be necessary in the future as more condors are reintroduced. Furthermore, the potential expansion of the nonessential experimental area would provide an opportunity to develop additional groups of free-flying condors with separate activity centers (e.g., condor release and/or feeding sites) by maintaining the option to use the Hurricane Cliffs site and/or other potential sites, for holding and/or release of birds. Management flexibility is an important part of responding to new challenges in the reintroduction program.

Monitoring and Data Collection

Prior to release, each condor was fitted with patagial (wing)-mounted number tags and two conventional radio telemetry transmitters (and/or occasionally a tail mounted transmitter) to aid biologists in monitoring and tracking individual birds. Redundant transmitters provided added security in case of failure of one of the units; the birds were recaptured every six months and transmitters replaced as needed (about once a year). In addition, blood samples were taken to check for potential lead poisoning. The field crew of usually four to six biologists intensively monitor the birds aided by traditional radio telemetry. Biologists made daily contact with each bird by radio signal and/or visual observation over 80 percent of the time. Various data were recorded concerning the birds' location, feeding activities, and behavior. Condor activity was closely monitored so biologists could intervene as necessary in response to behavior (e.g., perching on a human structure; approaching people) or health needs (e.g., malnutrition; poisoning; injury) of a bird. However, many of the details regarding the birds' activities remained unknown due to rugged terrain, limited road access, and long-distance flights that condors are capable of making. On 24 August 2001, a solar powered Platform Transmitter Terminal (PTT unit) that is monitored by satellite, was placed on the most wide-ranging condor, #176. This condor was at one point completely on her own for five months. During that time biologists were rarely able to locate her, even with the aid of fixed-wing aircraft. The satellite transmitter is programmed to emit signals once an hour over an eight-hour period during daylight hours. Readings are received daily. The satellite transmitter has proven to be a valuable and efficient tool in tracking the movements of this bird. Additional tracking techniques under development by The Peregrine Fund include sophisticated satellite/GPS (Global Positioning

System) location monitoring and recording systems. However, improved methods of data recording, summarization, and reporting need to be implemented.

Behavior

Like many scavengers, California condors are exceptionally curious. Curiosity and associated "play" behavior are most likely adaptive traits that developed over the condor's evolutionary history and may have helped ensure its survival (perhaps enhancing learning and memory in a long-lived species). In a human-dominated world, such curiosity can be manifested as an overall fearlessness of humans. Historic accounts suggested that some wild condors were unwary and sometimes even drawn to human activity (Snyder and Snyder 2000). In released condors, excessive curiosity and unwariness can be undesirable when it places the birds at risk or results in the destruction of human property. Despite being extremely gregarious, condors exhibit individual personalities and show varying degrees of curiosity and wariness. During the last five years, the majority of released condors in Arizona exhibited acceptably curious behaviors, while only a few individuals showed unacceptable levels of curiosity.

Acceptably curious behaviors included frequent fly-bys near people, persistently perching close to people or perching in populated areas, and playing with trash and other anthropogenic objects. Condors that exhibited these curiosity levels typically would have an escape route and did not physically interact with humans. On rare occasions (e.g., five times documented in 2000 and at least three times in 2001), such free-flying condors engaged in destructive behavior, such as tugging on and ripping tents at unattended back-country campsites. Despite the undesirability of such behaviors, manipulating and pulling on objects may teach important survival skills and are "natural" exploration, learning, and play behaviors for condors. Unacceptably curious birds would place themselves in situations of increasing jeopardy, perching in dangerous areas with no escape routes, and either initiating or allowing human contact. Such birds appeared to have no awareness for their own safety.

Figure 5. California condor soaring past visitors at Grand Canyon National Park. Photo by: Chris Parish

Excessive curiosity and its associated "bad" behaviors are typically most prevalent in juveniles. Young released birds were more likely to show excessive curiosity, unwariness of humans, and other behavioral problems than were older birds. Such undesirable behavior seemed to peak when the birds' were first exposed to humans or developed areas. Over the course of five years of releases in Arizona, there appeared to be a natural decrease in excessively curious behavior with increased age, time in the wild, and overall experience of the bird. Nevertheless, biologists worked to hasten this process and to maximize the number of behaviorally "successful" birds in the wild. Because birds were released without their parents, biologists had to act as surrogates in shaping desirable condor behavior. Birds exhibiting acceptable condor curiosity were (and continue to be) consistently and persistently hazed to flush them from undesirable perches (e.g., human structures and perches near humans) or to discourage undesirable behavior. Hazing of condors consisted of yelling or clapping, running toward the birds, using noisemakers, or spraying water at the condors. As condors aged and gained experience in the wild, they typically required less hazing before leaving an unacceptable area and, in general, were less likely to repeatedly frequent unacceptable areas. The placement of perching deterrents (e.g., nixolite) at locations where condor use is not desirable (e.g., Orphan Mine, Grand Canyon; utility poles at Grand Canyon Village) has been successfully used. However, once condors are regularly perching/using a site, it is much more difficult to stop that behavior than to prevent it from happening in the first place. Generally, the summer months provided good flying conditions (e.g., thermals; long day-light hours) when the condors tended to range farther and encounter more opportunities to engage in inappropriate behavior.

Condors exhibiting unacceptable curiosity and unwariness of humans were typically recaptured for either short- or long-term (greater than several months) "time-outs." Temporarily removing such birds from the free-flying population typically disrupted the negative behavior pattern in the problem bird, allowed the bird some important "growing-up" time, and removed a bad influence on other condors that were exhibiting desirable behavior. Temporary "time-out" was a frequently used management technique with 26 condors being captured and temporarily held at least once (Table 2). This often resulted in marked improvement in the behavior for almost all of these condors.

Table 2. Condors temporarily held in captivity (through January 31, 2002) due to behavioral concerns. WCBP = World Center for birds of Prey, Boise, Idaho.

Condor	Capture Date	Reason for Time-out	Time-out Duration	Re-release Date	Post-holding Status
70	29 Dec 2000	Improper roosting	---	---	Captive breeding program
60	30 Dec 2000	Improper roosting	---	---	Captive breeding program
114	19 Aug 1999	Modify group behavior	18 days	6 Sept 1999	Currently free-flying
123	12 Aug 1999	Modify group behavior	25 days	6 Sept 1999	Currently free-flying
126	4 June 1007 20 June 1997 13 July 1997	Behavior problems Behavior problems Fed by humans	4 days 11 days 899 days	8 June 1997 1 July 1997 29 Dec 1999	Free-flying 12 days Free-flying 12 days Currently free-flying
127	17 Aug 1999	Modify group behavior	22 days	8 Sept 1999	Currently free-flying
136	21 Aug 1999	Modify group behavior	16 days	6 Sept 1999	Currently free-flying
142	21 Dec 1996	Behavior problems	6 days	27 Dec 1996	Free-flying 5 months-dead
149	12 Aug 1999	Modify group behavior	28 days	8 Sept 1999	Currently free-flying

150	12 Aug 1999	Modify group behavior	25 days	6 Sept 1999	Free-flying 9 months-dead
158	12 Aug 1999	Modify group behavior	45 days	26 Sept 1999	Currently free-flying
162	12 Aug 1999	Modify group behavior	45 days	26 Sept 1999	Currently free-flying
176	28 July 1999	Modify group behavior	52 days	18 Sept 1999	Currently free-flying
182	28 July 1999	Modify group behavior	52 days	18 Sept 1999	Free-flying 9 months-dead
184	28 July 1999	Modify group behavior	60 days	18 Sept 1999	Free-flying 12 mos.-dead
186	26 Mar 1999 7 April 1999 23 May 2001	Behavior problems Behavior problems - handled by people Negative influence on juveniles	6 days 634 days 205 days	2 April 1999 29 Dec 2000 14 Dec 2001	Free-flying 5 days Free-flying 5 months Currently free-flying
187	12 Aug 1999 9 July 2000	Behavior problems Behavior problems	87 days 86 days	7 Oct 1999 3 Nov 2000	Free-flying 9 months Currently free-flying
191	28 July 1999	Modify group behavior	52 days	18 Sept 2000	Free-flying 9 months-dead
193	17 Aug 1999	Behavior problems	82 days	7 Nov 1999	Currently free-flying
195	11 April 2000	Behavior problems	661+ days	---	In captivity at WCBP Expected release 16 Feb02
196	15 April 2000	Behavior problems	330 days	12 Mar 2001	Currently free-flying
198	13 April 2000	Behavior problems	333 days	12 Mar 2001	Currently free-flying
203	14 April 2000 14 May 2001	Behavior problems Behavior problems	332 days 214 days	12 Mar 2001 14 Dec 2001	Free-flying 2 months Currently free-flying
224	16 Jan 2001 14 May 2001	Behavior problems Behavior problems - fed by humans	15 days 214 days	31 Jan 2001 14 Dec 2001	Free-flying 2 weeks; held for health 24 days; free-flying 63 days Currently free-flying
227	30 Jan 2001	Behavior problems	41 days	12 Mar 2001	Currently free-flying
232	4 Jan 2001 1 Feb 2001	Behavior problems Behavior problems	27 days 365+ days	31 Jan 2001 ---	Free-flying 1 day In captivity at WCBP

Releasing condors at a site where older birds were present also seemed to improve the behavior of juveniles. Compared to juvenile birds released at Vermilion Cliffs in 1996 (when no free-flying birds were present) and 1997 (when no adults were present), and at Hurricane Cliffs in 1998 and 1999 (where no free-flying birds were present), the cohort released at Vermilion Cliffs in 2000 (with adults present) exhibited fewer behavioral problems (however, additional factors may have also influenced this result). Although these juveniles still frequented "people-areas" such as Grand Canyon National Park's South Rim, they typically selected better perches from the outset, or they moved to desirable perches and did not persist in unacceptable behavior when hazed.

To most effectively manage the condor population, biologists must be proactive in modifying the behavior of released birds. Persistent and consistent hazing should continue in the field for birds exhibiting normal curiosity, while recaptures and time-outs (and subsequent re-releases) should continue for problem birds. Hazing and/or placement of perching deterrents should occur as soon as a problem situation is identified. Problem birds should be returned to captivity before they become an adverse influence on other free-flying birds. Expanding the opportunities to educate the public about the natural behavior patterns of condors and to not approach or feed the birds has been a major component of the program.

Courtship and Egg Laying

Figure 6. Site of first nesting attempt by reintroduced condors, Grand Canyon National Park. Photo by: Chris Parish.

The age of first breeding for captive California condors is usually between five and seven years of age. The year 2001 marked the first year that any of the condors in Arizona were of breeding age. While courtship activities have been observed in previous years, courtship displays intensified during the winter of 2000-2001, and by the end of February as many as five males had been observed displaying to females. This was also the first time cave exploration was observed. The highlight to date of the condor reintroduction program in northern Arizona occurred on 25 March 2001, when it was confirmed that one of the condors had laid an egg—the first confirmed condor egg laid in the wild since 1986. Unfortunately, the egg broke sometime within the first week of incubation, and the nesting attempt failed. Nonetheless, first nesting attempts often fail with condors in the wild and in captivity. The egg laid in 2001 remains a positive sign that condors are exhibiting normal behaviors and that successful breeding in the wild may occur in the near future.

Movements

Condor activity in Arizona has been, as expected, centered inside the designated nonessential experimental area. Condors of all ages, but especially older birds, travel throughout the Grand Canyon complex and along the Colorado River corridor. More recently, condors have been foraging on the Kaibab Plateau, and occasionally flying into southern Utah. However, on at least six occasions (Table 3) condors have moved outside the experimental population area. The longest movement recorded so far was about 310 miles to the northeast, to the Flaming Gorge Reservoir on the Wyoming/Utah border. Other significant movements include three birds venturing to Grand Mesa and two to Mesa Verde National Park in western Colorado, one bird traveling as far as Milford, Utah, and most recently, one bird to an area near Parker Dam on the

Arizona/California border (Figure 6). Four long-distance flights involved young birds (4 years old or less) apparently following major river corridors (i.e., Colorado, Green, and San Juan rivers). These appeared to be exploratory flights, being of short duration (less than 7 days) and generally isolated incidents (Table 3). However, a single condor (#176), originally released at Hurricane Cliffs, has repeatedly frequented areas near Cedar City, Utah, and on at least two occasions ventured west of the experimental area boundary. This is the only location near the experimental area boundary that has been regularly visited by a condor, and where movements outside the experimental area did not follow major river corridors. Nonetheless, the proportion of time condors are known to have spent outside the experimental population area over the past five years is minimal. Of a total of 29,636 free-flying condor days, an estimated 48 condor days (0.16%) were spent outside the experimental area. Other movements outside the nonessential experimental area could have occurred, but where not confirmed by the field crew.

Table 3. Summary of confirmed condor movements outside of the nonessential experimental population area.

Condor	Age (yrs)	Departure Date	Departed From	Approx. Distance (miles)	# Condor Days Outside 10(j) Area*	Farthest Point (General Area)
119	3	31 July 1998	Vermilion Cliffs	310	5	Flaming Gorge Res., WY
176	1	22 May 1999	Hurricane Cliffs	125	5	Cedar City/Milford, UT
116 122 123	4	23 June 1999	Vermilion Cliffs	275	9 - 15	Grand Mesa, CO
176 191	1	28 June 1999	Vermilion Cliffs	200	4 - 6	Mesa Verde NP, CO
176	3	3 Sept 2001	Vermilion Cliffs	80	2	South of Cedar City, UT
198	2	21 Nov 2001	Vermilion Cliffs	210	15	Parker Dam, AZ/CA

* Number of condors multiplied by the maximum number of days (liberal estimate) outside the 10(j) area.

Although movements by condors outside the experimental area have, in the past, been relatively rare, with growing numbers of free-flying condors and the increasingly experienced birds in Arizona, the frequency of significant movements and the likelihood of dispersal is expected to increase. As the previous flights have shown, condors are capable of traveling very long distances in a short period of time (e.g., 200+ miles/day), making such movements difficult to track. With continued release of condors in Arizona, consideration should be given to: 1) expanding the nonessential experimental area to include at least, the entire states of Utah, Colorado, New Mexico, and Arizona, and a portion of southwestern Wyoming, to allow for the wide-ranging exploratory flights and dispersal by condors; and 2) expanding the use of satellite telemetry to better track the flights of wide-ranging birds.

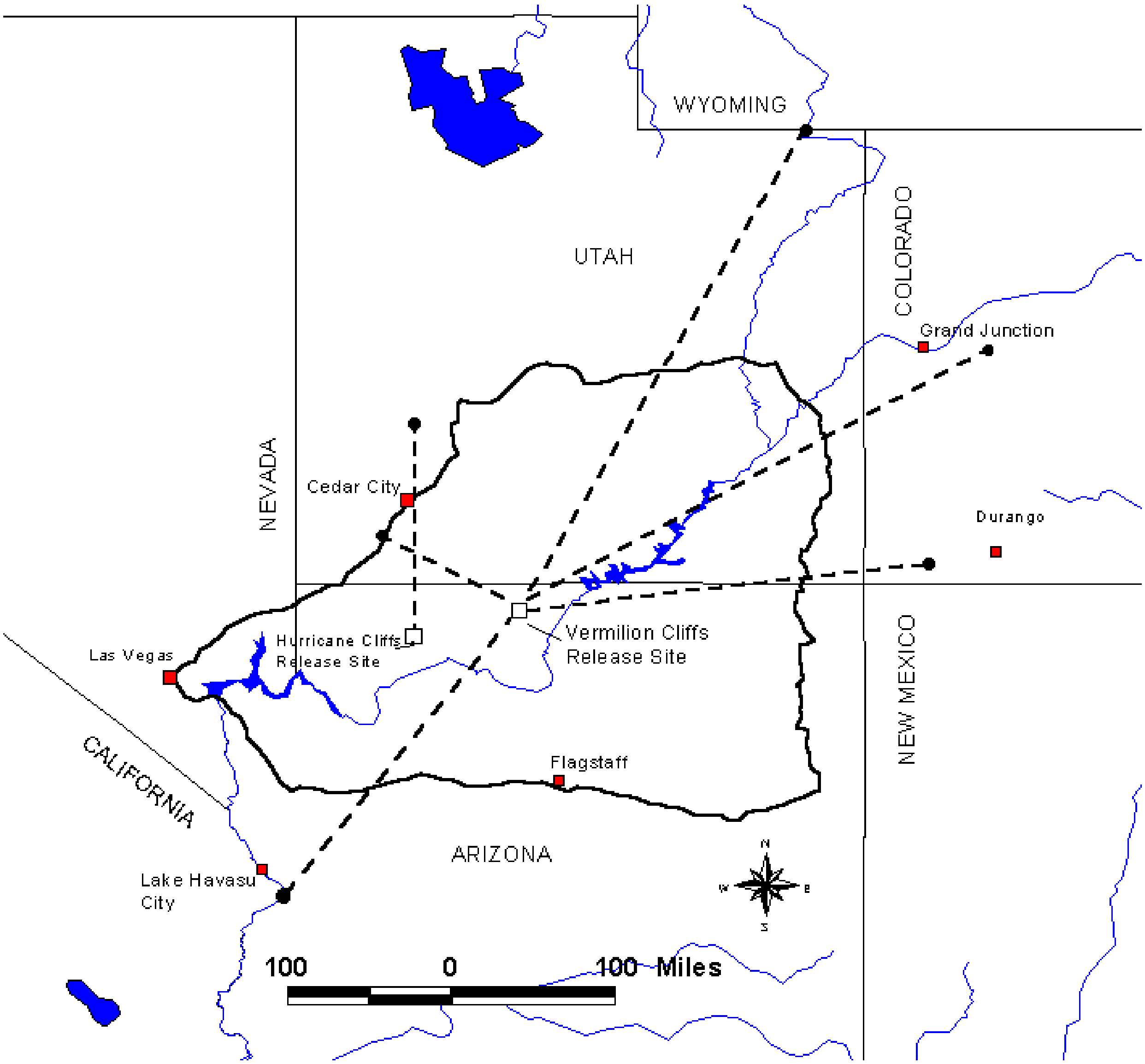

Figure 7. Known movements of condors outside the designated nonessential experimental population area.

Feeding

California Condors feed exclusively on carrion, and mainly on the carcasses of large mammals. Amid concerns that condors lacked the food-finding skills necessary to survive without supplemental food, and that there was an inadequate prey base in northern Arizona, the initial strategy of the supplemental feeding program was to encourage "natural-like foraging." Food (i.e., carcasses) was provided within the vicinity of the release site, but in unpredictable locations and only when birds were present for extended periods. Consequently, many birds ranged widely and were self-sufficient for varying lengths of time. This was especially true during the summer. Condors fed commonly on naturally-occurring carcasses including bighorn sheep, mule deer, elk, range cattle, dog, horse, squirrel, fish, and duck. Although natural foraging was, at the time, seen to be very positive, the feeding management strategy abruptly changed following the spring and summer of 2000 when several condors perished and many others were stricken by lead poisoning. In this case, several condors had ingested lead shotgun pellets while feeding on a contaminated carcass. From that time forward, a constant food source has been provided at the Vermilion Cliffs release site. Lead shot and bullet fragments remaining in game animal carcasses pose a potential health threat to condors. Carcasses of still-born dairy calves are provided in an attempt to reduce the bird's movements and minimize the occurrence of natural feeding, thereby reducing the potential exposure to lead. This, it seems, has reduced the overall amount of time spent away from the release site and reduced the ranging behavior of many of the condors. Still, birds commonly feed on naturally-occurring carcasses. Also, the practice of providing road-killed carcasses to feed condors at the release site was not initiated because of the possibility of contamination (see "Health").

There have been several important findings over the past five years relative to the original concerns regarding feeding and food availability. First, condors of all ages, but especially the older birds, have demonstrated a remarkable ability to find food. For example, between April and November 2001, the birds discovered at least 17 large carcasses, and many more were likely fed upon during this time. Additionally, although birds have and continue to find non-proffered carcasses, feeding by condors along roadsides on road-killed animals has not been a problem. There are only a few instances of condors being attracted to and/or scavenging road-killed animals (elk, deer, and squirrel). Despite supplemental feeding at the release sites, condors of all ages continuously make short trips away from the site, and some have traveled widely. Several birds have moved away from the site for extended periods (for up to five months), during which time they have been entirely self-sufficient in finding food. Therefore, mounting evidence suggests that condors are not only capable of finding enough food, but that some birds will continue to forage naturally and travel widely regardless of the amount and regularity of supplemental food provided at the release site. Nonetheless, providing a stable and safe food source at the release site is critically important.

Dairy calf carcasses are provided as a supplemental food source for condors at the release site. At the rearing facilities young condors are fed a variety of smaller foods; these young birds are not introduced to larger carcasses until after being transported to the release site in Arizona. Although most young birds adjust to the different food source quickly, exposure to larger carcasses while at the breeding facility might better facilitate this transition.

Mortality

Mortality in a wild population can be considered in two ways: physical mortality (i.e., actual deaths), or ecological mortality (i.e., birds permanently removed from the population by being placed into captivity). Of the 47 condors released in northern Arizona, 25 remain and constitute the free-flying flock. This reflects a loss of 22 birds (including deaths and returns to captivity) or a "mortality" rate of 47 percent. However, the release of four adult condors (two mated pairs) was part of an experiment to test how well adult birds raised in captivity could survive in the wild (see "Release Strategies"). Upon release, inappropriate roosting behavior of these adult birds left them more vulnerable to predation by coyotes. Two birds were killed by coyotes; the other two captured and returned to captivity. The removal of these four birds from the free-flying population has been excluded from the general comparisons with mortalities of condors released as juveniles.

Excluding the release of the adult pairs, there has been a loss of 18 birds from the free-flying population (16 deaths and 2 currently held in captivity), or a 42 percent "mortality" rate. Since the two birds being held in captivity may still be re-released to the wild (one is scheduled for release in early 2002), they will not at this time be considered "ecological mortalities," and so be removed from the calculation of mortality rate.

Of the 43 condors released as juveniles there have been 16 deaths (37%). Of the 16 physical mortalities, five deaths were confirmed or suspected as caused by lead poisoning, three condors were killed by golden eagles, one confirmed and one suspected killed by coyotes, one by collision with a transmission line, one by gunshot, one by starvation, and one by lethal aspiration (suffocation suspected to have followed gorging by a very hungry bird); two condors were lost and presumed dead due to unknown causes (Table 4).

Table 4. Sources of mortality for 16 subadult and 2 adult condors released in northern Arizona (modified from Woods *et al.* 2001, and The Peregrine Fund 2001 Annual Report to FWS). Birds are listed by the number of days free-flying prior to death.

Condor	Source of Mortality	Sex	Age at Release (yrs)	Age at Death (yrs)	Days Free-flying
82	Coyote	F	9	9	19
74	Coyote	M	9	9	22
142	Golden eagle (probable)	M	<1	<1	22
177	Coyote	M	<1	<1	39
207	Lethal aspiration	M	<1	<1	39
228	Starvation	F	<1	<1	43
197	Golden eagle	F	<1	<1	59
128	Lost	F	2	2	62
211	Lost	F	<1	1	119
151	Transmission line collision	F	<1	1	157
169	Coyote (unconfirmed)	M	<1	1	315
191	Lead poisoning	F	<1	2	518
182	Lead Poisoning (unconfirmed)	M	<1	2	519
184	Golden eagle	F	<1	2	535

124	Gunshot	F	2	2	608
165	Lead poisoning	M	<1	3	927
116	Lead poisoning	M	2	5	1006
150	Lead poisoning (unconfirmed)	F	<1	4	1260

Nine birds died within the first year of their release (discounting the release of the adult pairs). Of these, four died from depredation (golden eagle and coyote), one from a collision, and one due to starvation. These deaths are attributed to factors related to inexperience in the wild. The collision with a transmission line appeared to be mid-span, suggesting that the aversion training against perching on power poles was not at issue. The collision may have resulted from: 1) poorly developed flying skills; 2) lack of knowledge of the habitat; and/or 3) poor visibility of transmission lines due to weather, lighting conditions, or line reflectiveness. For birds that were free-flying for more than one year, the single greatest mortality factor was lethal exposure to lead contaminants (lead shot or lead fragments from spent ammunition ingested by feeding condors). Five birds are known or suspected to have died due to lead poisoning (Table 4); seven other condors had high lead levels in the blood upon re-capture (over 200 ug/dl blood lead and/or ingested shot pellets) and likely may have died had they not been treated with chelation therapy (chemical method of removing lead contaminants from the circulatory system) (Table 5; see "Health"). It is important to note however, that four of the five birds who's deaths are attributed to lead poisoning, and likewise nine chelated birds, died or were treated within a single period in June-July 2000, possibly representing a single poisoning incident. Five of these condors were known to have ingested lead shotgun pellets (birdshot size). How lead shot came to be in the carrion fed upon by condors is unknown. The carrion and source of lead shot were never determined. Fatalities by causes other than poisoning were limited for the experienced birds (free-flying for more than one year) to one condor that was shot and another killed by a golden eagle. Although natural mortality accounted for several deaths of younger condors, all but one death of older, more-experienced birds was directly related to anthropogenic factors, most notably lead poisoning (modified from Woods *et al.* 2001). It is unknown if condors which have experienced high lead exposure levels and/or have been chelated may develop physiological or neurological problems.

With intensive management, especially within the first 60 to 90 days following release, it may be possible to prevent some types of natural mortality. Experimenting with methods such as holding birds on-site in flight pens for longer periods, and providing exposure of pre-release condors to older "mentor" birds, may improve behavioral survival skills and the physical condition of the birds upon release. However, while every bird is critically important, adult mortality has a greater effect on the long-term population growth rate than the loss of juveniles (Verner 1978; Meretsky *et al.* 2000; Woods *et al.* 2001). Therefore, while efforts to minimize natural mortality factors during the first year post-release must continue, measures need also to be taken that would reduce anthropogenic mortality, especially those affecting older condors such as shooting and lead poisoning. To minimize overall condor mortality, general recommendations include: 1) intensive daily monitoring of the condor population; 2) expanded use of satellite telemetry and other location monitoring devices (e.g., GPS units) to identify condor movement patterns and flight corridors; and 3) intensive monitoring of roost-site selection by recently released birds. Specifically regarding the threat of lead poisoning, recommendations include: 1) continued provision of contaminant-free carcasses, and feeding site management; 2) continued monitoring of blood-lead levels in free-flying condors at least twice a year; 3) gather data on potential lead exposure sources (e.g., game carcasses and gut piles), contaminant levels in carcasses, and potential pathways of lead in the environment, possibly using surrogate species; 4) increased public education regarding the effects of lead on wildlife; and 5) establishment and maintenance of an on-site medical treatment center near each release location. Additional actions that could influence condor survival include: 1) behavioral conditioning trials with trained dogs (surrogate coyote); 2) coordination with utility companies and placement of visual markers on transmission lines at critical locations; 3) modifying captive management for longer holding periods; 4) continuing to provide elevated perches and mock power poles within the holding pen; and 5) expanding on the use of adult mentors.

Health

Various contaminants, poisons, and diseases pose serious health risks for condors. The natural food of condors is one potential source of contaminants and disease, even though condors have remarkable immune and digestive systems. Proffered carcasses were available for condors at the release site on a dependable basis. This food was carefully selected and only the carcasses of dairy calves obtained from a select group of dairies in the Phoenix, Arizona, area were provided to condors. All carcasses were kept frozen until just prior to feeding and were free of injections of artificial hormones or antibiotics.

If, through close monitoring of the birds, any condor was suspected of health related concerns, it was captured, and tested, treated, and/or cared for as necessary (Table 5).

Table 5. Condors captured for health related reasons, including capture for testing of blood lead levels (through 31 Jan 2002). Lead values are for blood (unless otherwise indicated) as tested in the laboratory; field test kit values within brackets [ ]. Only maximum blood lead level is reported for a holding period.

Condor	Capture Date () Release Date	Holding Duration (days)	Reason / Treatment
114	19 Aug 1999	–	Lead 9 ug/dl
	19 April 2000	7	Lead 3 ug/dl
	11 July 2000	54	Lead [36.1 ug/dl] 45 ug/dl
	(3 Sept 2000)	--	Lead [10.3 ug/dl]
	6 May 01	--	Lead [8.8 ug/dl]
	7 Oct 2001	--	Lead [2.6 ug/dl]
116	2 Mar 2000	Dead	Lead 3200 ug/dl liver

119	15 April 2000	26	Lead	109 ug/dl	Treated at Phoenix Zoo Radiographed Chelated
	13 May 2000	--	Lead	[10 ug/dl]	
	13 July 2000	52	Lead	52 ug/dl 1 pellet	Radiographed Chelated
	(3 Sept 2000)	--	Lead	[10.1 ug/dl]	
	6 May 2001	--	Lead	[17.8 ug/dl]	
	14 Oct 01	--	Lead	[18.1 ug/dl]	
122	16 April 2000	5	Lead	10 ug/dl	
	11 July 2000	54	Lead	210 ug/dl	Chelated
	(3 Sept 2000)	--	Lead	[16.2 ug/dl]	
	6 May 2001	--	Lead	[18.6 ug/dl]	
	14 Oct 2001	--	Lead	[25.2 ug/dl]	
123	31 Aug 1999	--	Lead	10 ug/dl	
	21 April 2000	6	Lead	1 ug/dl	
	2 July 2000	63	Lead	322 ug/dl	Chelated
	(3 Sept 2000)	--	Lead	[12.4 ug/dl]	
	18 Feb 2001	--	Lead	[16.1 ug/dl]	
	6 May 2001	--	Lead	[19.7 ug/dl]	
	7 Oct 2001	--	Lead	[22.5 ug/dl]	
124	20 July 1997	45	Emaciated		Treated at San Diego Wild Animal Park
126	20 April 2000	6	Lead	9 ug/dl	
	10 July 2000	47	Lead	[4.1 ug/dl] 6 ug/dl	
	6 May 2001	--	Lead	[4.6 ug/dl]	
	7 Oct 2001	--	Lead	[3.6 ug/dl and 7.4 ug/dl]	
127	17 Aug 1999	--	Lead	7 ug/dl	
	16April 2000	5	Lead	1 ug/dl	
	29 June2000	96	Lead	136 ug/dl	Chelated
	3 Oct 2000	--	Lead	[6.6 ug/dl]	
	6 May 2001	--	Lead	[5.6 ug/dl]	
	7 Oct 2001	--	Lead	[7.2 ug/dl]	
133	16 April 2000	5	Lead	3 ug/dl	
	11 July 2000	50	Lead	150 ug/dl 1 pellet	Treated at Phoenix Zoo Radiographed, Endoscopy, Gizzard flushed, Chelated
	(30 Aug 2000)	--	Lead	[13 ug/dl]	
	18 Feb 2001	–	Lead	[11 ug/dl]	
	6 May 2001	–	Lead	[15.4 ug/dl]	
	7 Oct 2001	--	Lead	[18.7 ug/dl]	

134	19 April 2000 29 June 2000 (3 Oct 2000) 18 Feb 2001	7 96 -- --	Lead 0 ug/dl Lead [32.5 ug/dl] 46 ug/dl Lead [4.8 ug/dl] Lead [9.2 ug/dl]
136	21 Aug 1999 16 April 2000 13 July 2000 (30 Aug 2000) 6 May 2001	-- 5 48 -- --	Lead 32 ug/dl Lead 11 ug/dl Lead 118 ug/dl 2 pellets Radiographed, Chelated Lead [3.5 ug/dl] Lead [12.5 ug/dl]
149	12 Aug 1999 15 April 2000 13 July 2000 (3 Oct 2000) 6 May 2001 14 oct 2001	-- 6 83 -- -- --	Lead 15ug/dl Lead 1ug/dl Lead 101ug/dl Chelated Lead [10ug/dl] Lead [11.3 ug/dl] Lead [22.2 ug/dl]
150	12 Aug 1999 15 April 2000 25 June 2000	-- 6 Dead	Lead [11 ug/dl] Lead 2 ug/dl Lead - unconfirmed
158	12 Aug 1999 16 April 2000 2 July 2000 (3 Oct 2000) 18 Feb 2001 14 Oct 2001	-- 5 94 -- -- --	Lead 8 ug/dl Lead 1 ug/dl Lead 390 ug/dl 6 pellets Treated at Phoenix Zoo Radiographed, Endoscopy, Surgery Chelated Lead [5 ug/dl] Lead [26.3 ug/dl] Lead [16.6 ug/dl]
162	12 Aug 1999 15 April 2000 9 July 2000 (3 Oct 2000) 18 Feb 2001 6 May 2001 7 Oct 2001	-- 6 87 – -- -- --	Lead 8 ug/dl Lead 10 ug/dl Lead 285 ug/dl Chelated Lead [9 ug/dl] Lead [5.1 ug/dl] Lead [11.8 ug/dl] Lead [11.5 ug/dl]
165	16 April 2000 12 June 2000	5 Dead	Lead 1 ug/dl Lead 3400 ug/dl liver 17 pellets
176	28 July 1999 15 April 2000 25 June 2000 (27 Aug 2000) 6 May 2001 14 Oct 2001	-- 6 63 -- -- --	Lead 14 ug/dl Lead 1 ug/dl Lead [14.9 ug/dl] 25 ug/dl Lead [3.4 ug/dl] Lead [14.7 ug/dl] Lead [23.9 ug/dl]
182	28 July 1999 19 April 2000 20 June 2000	-- 7 Dead	Lead [5 ug/dl] Lead 0 ug/dl Lead - unconfirmed

184	28 July 1999 19 April 2000 29 June 2000 (27 Aug 2000)	60 7 59 --	Botulism Treated at Phoenix Zoo Lead 0 ug/dl Lead [5.2 ug/dl] 9 ug/dl Lead [0 ug/dl]
186	7 Oct 2001	--	Lead [7.5 ug/dl]
187	12 Aug 1999 16 April 2000 9 July 2000 (3 Nov 2000) 18 Feb 2001 6 May 2001 14 Oct 2001	-- 5 (held for behavior) -- -- -- --	Lead 10 ug/dl Lead 6 ug/dl Lead [28.7 ug/dl] 44 ug/dl Lead [8.1 ug/dl] Lead [10.2 ug/dl] Lead [13.8 ug/dl] Lead [25.5 ug/dl]
191	28 July 1999 16 April 2000 15 June 2000 16 June 2000	-- 5 2 Dead	Lead 8 ug/dl Lead 14 ug/dl Lead 50 ug/dl Transported to Phoenix Zoo Lead
193	17 Aug 1999 15 April 2000 29 June 2000 (30 Aug 2000) 6 May 2001 7 Oct 2001	-- 6 62 -- -- --	Lead 10 ug/dl Lead 7 ug/dl Lead 34 ug/dl Lead [3.2 ug/dl] Lead [7.5 ug/dl] Lead [28 ug/dl]
195	11 April 2000	--	Lead 6 ug/dl
196	15 April 2000 14 Oct 2001	-- --	Lead 1 ug/dl Lead [18 ug/dl]
198	13 April 2000 14 Oct 2001	-- --	Lead 9 ug/dl Lead [4.3 ug/dl]
203	14 April 2000 6 May 2001 14 Oct 2001	-- -- --	Lead 10 ug/dl Lead [5 ug/dl] Lead [2 ug/dl]
210	6 May 2001 7 Oct 2001	-- --	Lead [3 ug/dl] Lead [1 ug/dl]
223	6 May 2001 7 Oct 2001	-- --	Lead [0 ug/dl] Lead [3.3 ug/dl]
224	16 Feb 2001 6 May 2001 7 Oct 2001	24 -- --	Malnutrition Lead [0 ug/dl] Lead [4 ug/dl]
227	6 May 2001 7 Oct 2001	-- --	Lead [0 ug/dl] Lead [3.6 ug/dl and 7.4 ug/dl]
228	9 Feb 2001	Dead	Starvation

234	6 May 2001 14 Oct 2001	-- --	Lead [0 ug/dl] Lead [24 ug/dl]
235	6 May 2001 7 Oct 2001	-- 30	Lead [0 ug/dl] Lead [50.6 ug/dl] 62 ug/dl

Nutrition

With increasing numbers of condors at the release/feeding site, it is becoming increasingly difficult to ensure that condors, especially recently released birds, are receiving a full crop and that their nutritional requirements are met. Although adequate food was available, one condor (#228) died at the release site from starvation six weeks after release during the winter of 2000/2001; two others were recaptured due to low body weight six and eight weeks following release (condors #224 and #124, respectively). Expanding on, and improving individual bird assessments and health-related measurements (e.g., weight, condition, behavior) both pre- and post-release, will help identify health (and behavior) related problems for treatment and/or management.

Contaminants and Poisoning

With condors often feeding on non-proffered carcasses, the potential for condor health problems and death from contaminants, poisons, and/or diseases is increased. During the five years of condor reintroductions, only the contaminant lead (possibly from lead bullet fragments, shot, and/or fishing equipment) has contributed to known toxicological condor morbidity and mortality (see “Mortality”). Considering the number of game animals harvested each year (and associated gut piles left behind) within the current foraging range of the condor, and the number of animals that likely go unrecovered by hunters, there is a substantial and ongoing risk of lead poisoning in condors. At the start of the reintroduction program in Arizona, it was anticipated that road-killed game animals would be collected and used to feed condors. However, road-killed animals are not used due to the difficulty in determining if these animals contain lead fragments (e.g., a deer with a pre-existing bullet wound) or other contaminants or diseases (e.g., a piece of chrome was found in one road killed deer while preparing the carcass to feed condors).

Following the death of four condors attributed to lead poisoning in the summer of 2000 (see “Mortality”), all 16 remaining free-flying birds were brought into captivity. These birds were held for six to twelve weeks to test for lead poisoning, provide any necessary treatment, and also to prevent them from returning to a contaminated carcass. Nine condors underwent chelation therapy; the most serous were transported to the Phoenix Zoo for treatment. Since that time due to the risk of lead poisoning, blood lead levels of free-flying condors were regularly tested (with the goal of testing each bird a minimum of twice a year). Blood samples would be tested with a field test kit (which had a maximum blood lead reading of 65 ug/dl), and based on the results of the field testing a sample would then be sent to a laboratory for additional analysis. Often, condors were held in captivity while awaiting laboratory results. Blood lead levels are reported in Table 5, with the number of days each bird was held due to health related concerns (including holding awaiting laboratory results).

Condors are naturally curious and tend to thoroughly explore their environment, potentially exposing them to various health risks. Though poisons and environmental contaminants have yet to cause a known condor death in Arizona, this remains a potential threat. For example, five cattle and two ravens were found dead on 15 February 1997, 12 miles north of the Vermilion Cliffs release site. Laboratory analysis (reported by BLM) indicated probable, but not confirmed, organophosphate poisoning. The BLM, The Peregrine Fund, AGFD, Utah Division of Wildlife Resources, and FWS jointly participated in an investigation. No source of the poison was found. At the Orphan Mine in Grand Canyon National Park, condors have been perching on the tower above the mine shaft (Figure 7) and from there investigating the associated ground debris and structures. The area surrounding this abandoned uranium mine is designated a hazardous waste site. Condors have been observed with their heads thoroughly coated in mine residue, potentially exposing them to various environmental contaminants. The Park has successfully excluded condors from the site.

Figure 8. Condors perched at Orphan Mine, Grand Canyon. Photo by: Bruce Palmer

The use of poisons, traps, and snares is outlawed on federal and state land in Arizona (Arizona Revised Statue 17-301 D-1); private lands and Indian Reservations are not affected by this State law. Various predator control devices are used legally (and illegally) within the geographic area used by reintroduced condors, including southern and southeastern Utah. Carcasses of dead predators could draw condors into an area and these anti-predator devices could also kill condors. As condors are social birds and often forage together, a number of mortalities could potentially occur in a single event. No known condor mortalities in the experimental population area have been attributed to anti-predator devices. However, the use of poisons and traps in the environment are a continuing risk to the condor reintroduction program.

In concordance with the nonessential experimental designation, no additional restrictions for the protection of condors within the designated area can be placed on currently-legal activities, such as using lead ammunition for hunting or legal placement of anti-predator devices. However, since lead poisoning continues as a substantial threat for the condor restoration project, several steps should be taken to reduce the risk of lead poisoning. There is a need for increased public education on the hazards of lead (ammunition, fishing equipment, and other sources) in the environment (to condors, eagles, other species, and people), and steps individuals can voluntarily take to reduce this hazard. Using notices in the annual publication of hunt regulations in Arizona and Utah, and other outreach materials, hunters could be encouraged to bury/cover gut piles and voluntarily use less-toxic (e.g., copper) or non-toxic ammunition as it becomes available. Various actions can be taken to manage the risk to condors from lead poisoning and environmental contaminants, as has been identified in the recommendations in the "Mortality" section. In addition, as soon as any potential risk of poisoning or environmental contaminant exposure is identified, take all necessary actions (including law enforcement involvement, as appropriate) to immediately address the problem with priority given to protection of surviving condors.

Disease

Free-flying condors are potentially exposed to various diseases and infections. No condor death in Arizona has yet been diagnosed as the result of an infectious disease. Diseases such as botulism, West Nile Virus, and foot-and mouth disease have been suggested as a possible concern for the condor reintroduction project in the future.

<u>Botulism</u>

One condor (#184) almost died from botulism in August 1999 while being held in the flight pen at Hurricane Cliffs. Usually fatal, botulism was diagnosed early and the condor was successfully treated at the Phoenix Zoo.

Additionally, between 17-25 August 1999, six mules belonging to the trail ride concessionaire at the North Rim of Grand Canyon National Park either died or were euthanized because of Type C botulism toxicity. This was within two weeks of the diagnosis of botulism in the condor. Botulism is caused by toxins produced by the bacteria *Clostridium botulinum*, which is closely related to bacteria that cause tetanus. Ravens were implicated as the mechanical carrier of the toxin from an infected carcass to the feeders/waterers used by the mules.

The mule owner initially believed that his mules contacted the disease from ravens which contaminated his feed and that the ravens probably got the botulism from calf carcasses which had been put out for the reintroduced condors. However, no link to the condor reintroduction program was established. because: 1) condors did not feed on proffered calf carcasses in 1999 between 15 May and 1 September; 2) the condor release site atop the Hurricane Cliffs is more than 80 miles distant from the mule barn; 3) the botulism organism commonly occurs in the soil; and 4) botulism can also occur in any carcass, including even a dead mouse in hay.

In resolving this issue, condor program personnel from BLM, The Peregrine Fund, FWS, and AGFD met several times with the owner and/or his representative, and contacted Grand Canyon National Park, the Zoological Society of San Diego's Director of Pathology, the Arizona Veterinary Diagnostic Lab, and the Phoenix Zoo veterinarian. The owner of the mules also contacted additional authorities including Dr. Robert Whitlock, Director of the Botulism Laboratory at the University of Pennsylvania.

The source of the botulism in the mules or the condor was never identified. As a precaution, the remains of proffered carcasses at feeding sites are now regularly removed from the area and buried. No further recommendations regarding the botulism issue appear warranted at this time.

West Nile Virus

West Nile Virus (WNV) is a disease which first appeared in the United States in 1999, and is caused by a flavivirus, similar to the yellow fever virus. Initially, people in Queens, New York, and birds at the Bronx Zoo became infected. The disease is generally spread by mosquitos, however it has also been shown that this disease can be transmitted from bird to bird without the need for an infected mosquito. The virus can infect (and be fatal to) birds, amphibians, and mammals; it is not host-specific. The WNV has now spread to 27 states, mostly east of the Mississippi River. According to Dickson Despommier, an authority on this disease at Columbia University, WNV is expected to spread to California by next year. He believes the disease is being spread by highway vehicles and trains, as well as by migrating birds (Despommier 2001; pers. comm. with Mike Small, 10 January 2001).

From a condor recovery perspective, WNV could be devastating. It has caused the death of at least 16 people and hundreds of thousands of corvids in the eastern United States. It has now been found in approximately 80 species of birds, including raptors.

Weather patterns often determine if a given pathogen succeeds or not. The southwestern United States appears to be an ideal climate for this disease with wet springs and long, hot, dry summers. The virus may be here shortly.

New World species of birds are especially vulnerable, apparently except for geese. Avian species from Europe, Africa, and Asia have some resistance. There is no vaccine. In the short term for the condor program, surveillance is key. Because WNV also attacks humans, the Center for Disease Control and Arizona State Health Department are on the alert for the virus to show up in Arizona.

Foot-and-Mouth Disease

Foot-and-mouth disease (FMD) is an acute, highly communicable disease chiefly confined to cloven-footed mammals. Cattle, swine, sheep, goats, bison, deer, and antelope are all susceptible in approximately the order listed. Horses are resistant to infection. This disease is not established in North America, Great Britain, and Australia where strict control and eradication measures are implemented. However, FMD is enzootic in certain parts of Europe, Asia, Africa, and South and Central America (Merck Veterinarian Manual 1967).

FMD is of concern for condors because if this disease were to become established in this area, the prey base of the condors could become significantly restricted. It is also possible that the condors themselves could spread the disease, as it is spread by contact with infected animals or contaminated fomites (abiotic carrier of disease). A rare outbreak of this disease occurred last year in Great Britain, or led to thousands of livestock being destroyed and millions of dollars in property losses. It is not currently a problem, but it has potential to become a very big problem in a short time.

ADMINISTRATION

Coordination Among Program Cooperators and Compliance with Commitments

The MOU established a framework for cooperation among the various state and federal agencies, tribal governments, and private organizations involved in the reintroduction of California condors in northern Arizona. Not all signature agencies/organizations had (or expected to have) the same level of involvement in the program at the time of signing. The agencies identified in the nonessential experimental rule as the "primary cooperators" with FWS and The Peregrine Fund were AGFD and BLM. These agencies were involved from the beginning stages of the program and have provided consistent support to the project. Primary coordination for this project for FWS was through the Arizona Ecological Services Office, with support from the Ventura Fish and Wildlife Office (FWS's condor program coordinator). The AGFD hired a condor coordinator whose primary duties included working with the field crew, public outreach efforts, and coordination among all program partners. This proved to be a very important position, and while it remained unfilled during personnel changes, the vacancy was evident throughout the program. The BLM provided the environmental documentation, and biological and archeological clearance work necessary for establishing release sites and associated facilities, as well as significant logistical and coordination support (see sections "ESA Compliance" and "Project Costs"). As the releases of condors progressed and the bird's activity patterns brought them more and more often to Grand Canyon National Park, it became evident that the Park had an ever increasing role in the reintroduction program. Though not originally identified as a primary cooperator, the Park has provided extensive logistical and program support, and even hired a biologist during the summer of 2001 to assist in monitoring the birds in the Park and to provide information about condors to Park visitors. The direct and active participation of AGFD, BLM, and NPS in coordination with FWS and The Peregrine Fund has proved critical to the condor reintroduction program in northern Arizona.

Coordination among all cooperators has not been as consistent. The Forest Service identified deficiencies in communication regarding condor related activities with the Kaibab National Forest. And coordination with Native American tribes has at best, been ad hoc. Various management agencies identified that specific permits required for condor related activities under areas of their jurisdiction have not been applied for or issued to field personnel. Permits required for condor related activities include, NPS-Grand Canyon (and several NPS units in southern Utah), AGFD, Arizona State Land Department, FWS, and BLM. Special permits or other mechanisms are required if it is necessary for the field crew to enter tribal lands. In general, coordination among the cooperators occurred on an as-needed basis. This has not proved to be fully satisfactory.

The MOU was establish in 1996 for a period of five years. It has now expired, though the agencies and organizations continue to coordinate and cooperate in the spirit of that MOU. In that the MOU has been an important vehicle for support of the condor reintroduction program, a new MOU should be developed. As the condor reintroduction program expands, it would be appropriate that several potential cooperators in a new MOU take a more active role in the program, including the Utah FWS Office, Utah Division of Natural Resources, Kaibab National Forest, and APHIS-Wildlife Services, and that there is closer coordination with others, including Navajo Nation, Hopi Nation, Havasupi Tribe, Hualapai Tribe, Kaibab Piaute Tribe, and Dixie National Forest. The MOU should clearly identify the expectations of each signature agency/organization of the program as well as each agency's/organization's contribution to or role in the program. For some agencies, simply identifying contact personnel or offices could facilitate resolving a field management issue. For example, cooperators can expedite issuance of permits; and perhaps the MOU could provide a mechanism to facilitate efficient fund transfers among program partners. Participation in the program through the MOU can provide a means of coordination and information to cooperators about the current status of the program. Renewed annual coordination meetings with all program cooperators may facilitate information exchange and better allow for evolving levels of participation by each cooperator as the condor reintroduction program progress.

The "Arizona Condor Working Group" is comprised of those MOU cooperators involved in the active management of the program. To provide the greatest support to the program, this group needs to meet regularly and work to address issues before problems arise. Though all cooperators are welcome to participate on the working group, there must be active participation by those agencies that have special information needs for management decisions or actions. The working group is the appropriate forum to identify and prioritize new data needs (e.g., condor movement patterns and specific movement corridors) and determine how to participate/assist in collecting and/or compiling the data. The working group is also an appropriate forum to coordinate program funding opportunities and requests.

The MOU, with the "Implementation Agreement with Local Governments" and nonessential experimental rule, established various commitments to be carried out with the implementation of the condor reintroduction program. Primary among those commitments was that there were to be no regulated changes in land uses due to the presence of condors. No land use changes on account of condors have occurred on BLM or USFS administered lands. The BLM did report that certain accommodations for the condors (and those who come to view the condors) have been made (e.g., road grading, sign postings, restricting entry immediately surrounding the condor holding pens, and modifying certain open topped water storage tanks to protect condors), but not through any regulatory action or at additional cost or restrictions on permittees. At Grand Canyon National Park, action was taken to include provisions for protection of condors during construction activities, and a temporary closure of the stairs at Mather Point occurred while condors perched at the site for about three hours, until permitted hazing of the birds could be conducted. The AGFD reports that they are not aware of any changes in land use practices due to condors and that the implementation of the Federal rule had gone well, with program cooperators adhering to the letter and spirit of the commitments. There has been no infringement on private property rights.

Certain prescribed program activities did not occur or were delayed. The FWS outlined in the final rule a strategy to include a hunter education program in order to address the potential threat of lead poisoning by condors. This was to be initiated in the first two years of the reintroduction efforts in cooperation with AGFD, BLM, and USFS; it has not yet occurred, but should be revisited by program cooperators. The FWS had not fully adhered to the coordination/information requirements under the "Implementation Agreement with Local Governments." The lack of regulatory or other problems associated with the condor reintroduction program reduced the priority (for FWS and local governments) for annual formal meetings to that of occasional phone calls and other conversations. Local government representatives and other parties of the Implementation Agreement could be invited to renewed annual MOU meetings to keep everyone up to date on the reintroduction program. Additionally, the stated objective of FWS to propose an expansion to the nonessential experimental area has been delayed (for a complete discussion of this issue see "Expansion of Nonessential Experimental 10(j) Population Area").

Compliance of Federal Agencies with Sections 7(a)(1), 7(a)(2), and 7(a)(4) of the Endangered Species Act

As part of the five year review process, federal agencies within the range of the reintroduction of California condors in northern Arizona were asked the following questions regarding compliance with the ESA.

> A. If the lands you manage are within the National Wildlife Refuge System or the National Park System, please answer the following questions. If the lands you manage are not within either of those systems, please go to B.

1. Reintroduction of California condors in Northern Arizona was done through the designation of a nonessential experimental population. Nonessential experimental populations located within National Wildlife Refuge System or National Park System lands are treated, for the purposes of section 7 of the Endangered Species Act, as if they are *threatened* species. Thus, for such populations, two provisions of section 7 would apply within such lands; section 7(a)(1), which requires all federal agencies to use their authorities to conserve listed species, and section 7(a)(2), which requires federal agencies to *consult* with the FWS on actions that may affect listed species. Have you been aware of these responsibilities under the Act since the nonessential experimental population was designated?

2. Please list and describe any actions you accomplished for the conservation of California condors under the requirements of section 7(a)(1).

3. Please list and describe any projects you implemented that required, with the results of, consultations conducted with the FWS under the requirements of section 7(a)(2).

B. If the lands you manage are outside of the National Wildlife Refuge System and the National Park System, please answer the following questions.

1. Reintroduction of California condors in Northern Arizona was done through the designation of a nonessential experimental population. Nonessential experimental populations located outside National Wildlife Refuge System or National Park System lands are treated, for the purposes of section 7 of the Endangered Species Act, as if they are *proposed* for listing. Thus, for such populations, two provisions of section 7 would apply outside such lands; section 7(a)(1), which requires all federal agencies to use their authorities to conserve listed species, and section 7(a)(4), which requires federal agencies to informally *confer* with the FWS on actions that are likely to jeopardize the continued existence of a proposed species. Have you been aware of these responsibilities under the Act since the nonessential experimental population was designated?

2. Please list and describe any actions you accomplished for the conservation of California condors under the requirements of section 7(a)(1).

3. Please list and describe any projects you implemented that required, with the results of, conferences conducted with the FWS under the requirements of section 7(a)(4).

The review received the following responses to the questions regarding section 7(a)(1) of the ESA, which requires all federal agencies to use their authorities to conserve listed species.

No responses were received from Glen Canyon National Recreation Area, the southwest Utah National Parks and Monuments; the USFS did not report any activities.

No activities were reported by the Arizona Strip Field Office of the BLM (see "Project Costs").

The Southeast Utah Group of National Parks and Monuments reported that, aside from monitoring for condor presence during annual bird surveys and other field work, no other conservation actions have been identified or implemented.

The BLM reported that USDA Wildlife Services conducted their activities on the Arizona Strip in a manner to ensure that condors were protected. For example, Wildlife Service's predator control activities have been closely coordinated with BLM, and certain areas near the release site on the Hurricane Rim have not been flown for aerial gunning of coyotes in order to avoid possible aerial conflict with condors. In addition, Wildlife Services uses only steel shot in its aerial gunning program, and they do not use traps, snares, or poisons on BLM lands on the Arizona Strip. Wildlife Services also collected coyote liver tissue samples which were analyzed for lead concentration (see "Wildlife Services Activities").

Grand Canyon National Park reported several actions including:

- raptor-proofed power lines within the developed zone where condors frequently perch and roost;

- affixed perching and roosting deterrent device to the Orphan Mine tower to prevent condors from frequenting the mine area;

- provided a condor technician to aid in the monitoring of condors and to prevent human/condor interactions;

- developed a standard operating procedure to ensure the safety of NPS and The Peregrine Fund staff while hazing and monitoring condors;

- developed an observation record for the Fire and Aviation Program;

- developed guidelines for interdivisional and interagency use pertaining to management of condors within park boundaries;

- developed a response and protection protocol for construction contractors to follow should condors perch, roost, or forage at or near a construction site; and

- developed a protocol for the removal and relocation of wildlife road mortalities to ensure that condors are not feeding in areas of risk or hazards associated with roads.

The review received the following responses to the question(s) regarding section 7(a)(2) and 7(a)(4) of the ESA which requires federal agencies to consult with the FWS on actions that may affect listed species.

No responses were received from Glen Canyon National Recreation Area, the southwest Utah National Parks and Monuments, and the USFS.

The Arizona Strip Field Office of the BLM responded that it was aware of its responsibilities to confer and implied that that responsibility has been carried out informally. Specifically, the condor has been considered in consultations on an existing land use plan, routine road grading of the House Rock Valley Road, and it will be considered in development of a new land use plan. They stated that almost all of the determinations of effect have been "no effect." The BLM stated that, in the future, they will take steps to better document those determinations with the proper contact for condor-related issues. They also mentioned the fact that the new Parashant National Monument is being jointly managed by both BLM and the NPS (as condors within National Park System administered lands receive protection as a threatened species under 10(j) of the ESA.

The Southeast Utah Group of National Parks and Monuments reported that they are aware of NPS responsibilities under section 7 of the Act. They stated the condor will be included, as appropriate, in consultations on actions that may affect the species. They reported that no projects have been undertaken that have required section 7 consultation for the condor.

Grand Canyon National Park reported that they are fully aware that condors of this nonessential experimental population are treated as a threatened species while in park boundaries. Condors were considered in consultations for several projects including the following that were reported by the Park:

- Greenway Trail
- Desert View Housing
- Grand Canyon National Park Mule Barn Construction
- Vista Fire
- Outlet Fire
- Tower Fire

During the review, Grand Canyon National Park also recognized a need to plan for future condor activities. For example, consideration should be given to the question of what management should occur if condors nest in a high use visitor area.

In late 1999 and early 2000, a formal section 7 consultation (2-21-97-F-085) was conducted by Grand Canyon National Park and the FWS Arizona Ecological Services Office regarding new flight rules for commercial air tours in the vicinity of the Park. That consultation resulted in a 26 January 2000, biological opinion addressing the effects of the proposal on, among other species, the California condor. That biological opinion concluded that the proposed project was not likely to jeopardize the continued existence of the California condor. The biological opinion included an incidental take statement which anticipated take of condors in the form of harassment or accidental displacement when startled individuals are flushed from a perch site by the proposed low-level flights, and take in the form of one individual killed in five years from collisions. The incidental take statement included one reasonable and prudent measure and several terms and conditions intended to minimize the anticipated take of California condors.

On 26 December 2001, a biological opinion (2-21-96-F-368) was issued by the FWS Arizona Ecological Services Office to the Environmental Protection Agency regarding the effects of the Proposed Navajo Nation Water Quality Standards on, among other species, the California condor. Due to the nonessential experimental designation, the condor was considered as a proposed species during the formal section 7 consultation. The resulting biological opinion concluded that the proposed action was not likely to jeopardize the continued existence of the condor. Incidental take was not anticipated, and there were no conservation recommendations specific to the condor in the biological opinion.

Because the response to the section 7 questions was uneven, it may be appropriate for FWS to issue a memorandum to the federal agency units which clearly outlines responsibilities and identifies appropriate FWS contacts. In addition, for example, the memorandum could include a description of the determinations of effect that are appropriate for each of the units (including NPS lands jointly or otherwise managed by BLM), and suggestions of general protective measures that have been developed through consideration of other projects. Additional items may be relevant and appropriate for inclusion in the recommended memorandum.

Unofficial Cooperator Initiatives

Assistance provided to the program by parties outside of the official cooperators listed in the reintroduction program MOU and the Implementation Agreement has been invaluable. Foremost, we acknowledge and thank Maggie Sacher, owner of Vermilion Cliffs Lodge, for her commitment and countless quiet contributions to the condor recovery program in northern Arizona. We recognize the importance of contributors to The Peregrine Fund; in addition to supporting The Peregrine Fund's captive rearing efforts, they continue to make possible transport, release, and field monitoring of condors in northern Arizona and southern Utah. Norm Freeman, director of "Elemental Technologies, Incorporated" of Phoenix, Arizona, has repeatedly provided flight services for field personnel searching for condors and has transported condors in need of medical attention. He is presently underwriting and overseeing the development of data recording devices that promise to provide immeasurable benefit for scientific and management data collection for condor recovery in Arizona and throughout its range. Grand Canyon Trust provided assistance in the public events surrounding the initial release of condors in Arizona. Salt River Project, Phoenix, Arizona, and Papillon Grand Canyon Helicopters, Tusayan, Arizona, have responded to requests to airlift condors and personnel to the release site. As a local promotional effort, the U.S. Post Master at Page, Arizona, contributed time and resources to develop and promote a California condor postal cancellation stamp in conjunction with the issuance of a California condor stamp and anniversaries of the condor release in Arizona. The Steven H. Rich Family and Ira Schoppmann Family, local landowners and ranchers, have provided accommodations for the field crew and water and sewage disposal hookups, biologists and public access across their land for field monitoring and public viewing of condors, and have assisted in developing program acceptance among locals. This is an incomplete list of the gracious support local residents, business owners, and elected representatives have provided to the condor program. However, the review team recognizes that local efforts and contributors have not only assisted greatly in condor recovery in the Southwest, but they are by a credible measure *the success* of the program. Their voluntary acceptance of, and exceptional commitment to the condor recovery program demonstrate a commendable natural resource ethic and stewardship responsibility for the biological resources of the area.

Public Acceptance and Interest

Levels of public acceptance of the condor reintroduction seem to vary among population segments and geographic area. Levels of enthusiasm and criticism have changed over the course of the reintroduction program. Most respondents to review team inquiries indicated an overwhelming and almost uniform acceptance of the program with few exceptions.

During the reintroduction planning and Federal rule development, the majority of commenters were supportive of the reintroduction effort. However, individuals from northern Arizona and south-central Utah communities ("locals") with historically or traditionally resource-based economies expressed vocal distrust of the Federal government, expressly criticizing FWS's intentions and lack of specific commitment to accommodating their concerns in the special rule. The FWS withdrew from its initially proposed schedule for the transport and release of condors until it could identify a consortium of local businesses and elected officials that could negotiate special rules for management of the condors within and outside of the nonessential experimental area. Once these concerns were met, local opinion leaders agreed to an at least tacit acceptance of the condors. These county and local leaders today express that "they don't have any opposition to the release of the condor as long as [they] are protected by the 10(j) area."[1] Leaders and governments on the periphery or outside of the 10(j) area continue to emphasize that expansion of the 10(j) area is a requirement for their continued acceptance of the program.

Over the course of the reintroduction, local publics have become increasingly accepting and supportive of the program due to increased understanding of the regulatory relief provided by 10(j) designation, program agencies' improved communications with local leaders, The Peregrine Fund personnel interactions within local communities, local presentations provided by principal cooperator agencies, and locals' exposure to condor-watcher tourists and project supporters. However, a local land owner, though stating local support for condor reintroduction success, did take issue with the "urban beliefs" of a few condor field team members. There are apparently still some concerns that the condor reintroduction could be used to limit private property and water rights. One individual expressed that an increase in bird watcher tourists, field crews, and

[1] Washington County Commissioners (Aldred, Gardner, Eardley). Correspondence of 26 November 2001.

release event attendance in the area is perceived as diminishing their traditional enjoyment of House Rock Valley for its remote characteristics.

Landowners and ranchers in the immediate area of the release were contacted well before the first releases so that we could understand and attempt to address their concerns. Most of the grazing operators were concerned that federal agencies from whom they lease grazing privileges would change the way they were permitted to run cattle on the land to accommodate the condors. For this reason, the FWS designated an extensive area where condors were to be released as "nonessential experimental." This designation guarantees that land management agencies (e.g., BLM; USFS) need not change land uses to accommodate the condors (except on National Park System or National Wildlife System lands). Additionally, some landowners and ranchers were concerned that biologists and bird watchers/tourists would leave cattle gates open, trespass, or get vehicles stuck on their land in pursuit of birds. The condor biologist staff operating in the area and local ranchers and landowners have become well acquainted, assist each other with monitoring people in the area, keeping roads in repair, and even identifying livestock in trouble. A livestock operator was concerned that bird watchers drawn to interpretive panels constructed below the Vermilion Cliffs release site would damage ground cover with vehicle traffic in the viewing area; The Peregrine Fund and BLM staff placed boulders in the area to limit vehicle access to land outside of the kiosk area. Because the immediately affected local ranchers and landowners were identified early in the program planning and had their concerns heard and met early in the process, we've been privileged in having them as program supporters.

Where/when people and condors meet too closely, there can be problems, both for the condors and humans (or at least their property). As scavengers, condors as a group have been successful for eons at locating food by being curious and seeking out locations of activity (e.g., coyote, saber-tooth cat, or raven assemblages; herd [mastodon or cattle] movements; water holes). Human congregations are active; and curious condors approach and can mix. This curiosity has brought condors to back-country campsites where they have ripped into tents and ice chests. Hopefully there is no food reward for birds that approach humans. Fishing guides, NPS rangers, and hotel and tourism professions in the area have all learned how to direct their clientele to maintain a respectful distance from condors (for the sake of birds and human property). One hiking/fishing guide and party sought compensation from The Peregrine Fund and FWS for equipment damaged by condors in Grand Canyon National Park. Under federal tort claims law, claimants entering an area of presumed wilderness and wildlife presence assume such risks, particularly if federal agencies are not found to be at fault in such events.

Participating agencies have given hundreds of presentations to tourists, schools, local governments, elder hostels, and civic, industry and environmental organizations. There were daily condor presentations during the summer months at Grand canyon National Park. Requests for such presentations and enthusiasm of audiences continue to be high. Grand Canyon National Park visitor correspondence frequently lists condor viewing as a highlight. Public attendance at condor release events has diminished, yet in December 2000, there were over 100 attendees, some having traveled from as far away as California and Wisconsin for the expressed reason of viewing the event (Figures 9a,b,c). Visitors stated satisfaction at release events and viewing at the Grand Canyon continues to be high.

Figures 9a,b,c. Viewing the condor release at Vermilion Cliffs , 29 Dec. 2000. Photos by: Bruce Palmer.

Economic Opportunities

Aside from local ranchers, most of the local business owners rely entirely or largely on tourism (Grand Canyon viewers and hikers, river rafters, or trout anglers). Many of these business owners and employees understand or appreciate the condors as an additional attraction for customers. Some people come to the area (and eat, lodge, buy gas, etc.) with condor viewing as their principle destination, others extend an already scheduled trip so that they can see condors, and others are persuaded to come to the area because of the "value added" benefit condors provide to tourism in the area. Even business owners (hotel, restaurant, and gas station operators, tourism boards and chambers of commerce) such as an auto mechanic from Fredonia, Arizona, and a Kanab, Utah, coffee shop owner have reported that they have customers who have done business with them (or their members) as the result of a condor destination vacation or a trip extended to accommodate condor viewing.

Law Enforcement

On 11 March 1999, condor # 124 was shot and killed within Grand Canyon National Park. The defendant in this case, Ronald Tenney Owens (age 24), turned himself in to law enforcement authorities, and was ultimately convicted on one count of violation of the ESA, and one count of violating park regulations restricting the possession and discharge of firearms. Owens was sentenced to one year of supervised probation; 200-hours community service; and payment of $3,200 in fines. This case is unique in that it marked the first successful prosecution under the ESA of a violation occurring within Grand Canyon National Park.

This shooting, as well as the condor lead poisoning event in the summer of 2000, also brought to light a number of deficiencies in the condor interagency MOU and resultant relationship between the FWS, NPS, AGFD, and personnel from The Peregrine Fund. Difficulties arose regarding various issues, including: chain of evidence; responsiveness of the forensic laboratory; investigation confidentiality; management of surviving condors; and law enforcement authorities.

Land Management Agency Law Enforcement Authorities

Clarification regarding jurisdictions and responsibilities of the major land management agencies involved in the reintroduction process include the following:

U.S. Fish and Wildlife Service

By statute, Special Agents of the FWS retain and may assert primary criminal jurisdiction over violations of federal wildlife law throughout the United States, generally without regard to other jurisdictions, including on Tribal lands. These agents may assert their authority with or without the concurrence of another federal agency that may also have jurisdiction (such as the NPS, BLM, or USFS). Similarly, they may assert their authority with or without the concurrence of any other state or local agency, and can supercede the authority of the state or local government where that sovereign's laws or activities conflict with federal law or interfere with lawful FWS activities.

In all cases, Special Agents of the FWS have and may assert primary jurisdiction over violations of the ESA, Lacey Act, and the Migratory Bird Treaty Act which may relate to the reintroduction of California condors.

Unless otherwise indicated in a local agreement, other federal agencies have a responsibility to confer with FWS before taking enforcement action for crimes otherwise under the primary jurisdiction of FWS.

National Park Service

Under the Organic Act (16 USC 1) and the General Authorities Act (16 USC 1a-6), NPS law enforcement personnel (Special Agents and U.S. Park Rangers) are empowered to take enforcement action (up to and including arrest) for violations of any federal law that occurs within the National Park System. Significantly, this investigative and other enforcement authority extends beyond the boundaries of the parks so long as the violation(s) being investigated occurred within the National Park System. The broad nature and scope of laws enforceable by NPS officers is unique among federal land management and resource protection agencies.

Included among the laws and regulations enforceable by NPS officers are NPS regulations at 36 CFR Chapter 1, including the regulations that specifically protect wildlife within a park (36 CFR 2.1 and 2.2). Further, NPS law enforcement personnel are empowered to investigate violations of any federal wildlife law (e.g., Lacey Act, Migratory Bird Treaty Act, Bald and Golden Eagle Protection Act, or the ESA) that occurs within the boundaries of a National Park System unit. In the case of the latter, FWS Special Agents have the authority to assume the lead investigative role in cases involving a violation of federal wildlife laws, since such laws are applicable nationwide. Where the violation of such a nationally applicable federal wildlife law occurs in a park, NPS and FWS may share this role, as spelled out in agreements or other written understandings.

Within NPS, sites governed by either proprietary or concurrent criminal jurisdiction, state wildlife officers may concurrently exercise state law enforcement authority within those park areas, enforcing their own non-conflicting state laws. That is, these officers may independently enforce (and investigate violations of) those state wildlife laws that do not conflict with superceding federal wildlife laws, regulations, and even policies, with concurrence from the State Attorney General. Absent a local agreement to the contrary, these officers do not need permission or authorization from NPS to engage in their own law enforcement activities, so long as their enforcement (or other) activities do not conflict with federal laws or other authorized federal activities of any kind.

The legal requirement that state wildlife enforcement and management activities not contradict or interfere with federal wildlife enforcement and management activities is uniquely at issue within national park sites. This potential for conflict arises directly from the statutory (and judicially reiterated) NPS mandate to protect and preserve wildlife, and to actively manage park resources in a manner consistent with those goals. This particular mandate and the related potential for conflict with state law enforcement and wildlife management activities gives rise to heightened importance for the establishment of clearly articulated and legally supportable agreements between parks and state wildlife management agencies.

Within NPS, sites under the exclusive jurisdiction of the Federal Government (e.g., Yellowstone, Mesa Verde NP; not Grand Canyon NP), state officials will generally have no law enforcement (or other) jurisdiction, and may not engage in enforcement or regulatory activities of any kind. In these areas, either NPS or FWS (and technically, the FBI) must assume the lead and act as the sole enforcement authority for criminal wildlife laws.

In practice within most NPS sites, NPS law enforcement officers generally assume the lead and are the primary enforcement entity for violations of wildlife laws within those sites.

Bureau of Land Management and U.S. Forest Service

As suggested above, law enforcement and resource management authorities and responsibilities delegated to both BLM and USFS are somewhat more limited than those authorities and responsibilities delegated to FWS or NPS. Law enforcement authorities of personnel employed by BLM and USFS are specifically limited by statute, and generally encompass enforcement of regulations promulgated by those agencies respectively, as well as specific criminal statutes relating to those resources under the primary jurisdiction of those agencies (e.g., minerals, horses and burros, timber). Also, in the case of the USFS, specific authority to enforce federal drug laws has been delegated to their law enforcement personnel (to help combat the cultivation or production of controlled substances on USFS lands). Consequently, responsibility for the enforcement of wildlife laws on both BLM and USFS lands generally falls upon state wildlife officers, to the extent that they do not interfere with or conflict with specific federal laws (including those under the jurisdiction of FWS) as advised by the State Attorney General. Similarly, wildlife management efforts are generally coordinated by the state, to the extent that they do not conflict with or interfere with the primary mission and activities of either BLM or USFS.

Federal Laws

Several federal laws that pertain to the recovery of the California condor include:

Airborne Hunting Statute, 16 U.S.C. 742j-1.
Endangered Species Act, 16, U.S.C. 1531-1544.
Fish and Wildlife Conservation Act, 16, U.S.C. 2901-2012.
Fish and Wildlife Coordination Act, 16, U.S.C. 661-667d.
Lacey Act and the Lacey Act Amendment of 1981, 16 U.S.C. 3371-3378.
Migratory Bird Treaty Act, 16 U.S.C. 715-715s.

Application of these laws must be considered when determining effects of expanding versus not expanding the nonessential experimental area as well as during law enforcement investigations.

The five-year review of the California condor reintroduction program in northern Arizona recommends that the partners in the program review the law enforcement protocols and include coordination of this review as a priority for the next interagency working group meeting in order to ensure complete and timely cooperation pertaining to incidents involving condors. This review of law enforcement protocols may result in: 1) revised protocols; 2) field forensic training for personnel; 3) improved coordination among law enforcement personnel, field biologist, and public affairs personnel, and the development of a "contacts" list; 4) defining a balance between the need to manage surviving condors and compromising an investigation; and 5) better communications and response from the FWS Forensic Laboratory.

Aviation

Air safety is of critical importance to the condor recovery program. As the Grand Canyon Ecoregion serves as a high-density tourist area for sight-seeing flights, every precaution to eliminate near misses and collisions with tour and administrative flights must be addressed.

Over areas of designated wilderness on BLM lands, aircraft are "advised" to be 2,000 feet above the ground level, but this is only advisory. Over Grand Canyon National Park, air tours and overflights have been a concern for years primarily because of noise related issues, and the Grand Canyon National Park Special Flight Rules Area has been established to regulate overflights up to 18,000 feet above sea level. The Special Flight Rules Area is focused on the National Park, but extends somewhat over adjacent land ownerships. Aircraft flight corridors and flight free zones have been established. The air tour industry is very active in the Grand Canyon area, but with the rules regulating how they can operate and appropriate awareness of the presence of condors, they pose little risk for the condors. In the five years of the condor reintroduction program there have been no reported condor strikes or near misses by air-tour operators. In some cases the condors have become one more interesting resource the air tour pilots can mention to their customers.

Agency aircraft, when conducting agency missions such as fire fighting, search and rescue, or game surveys, may fly relatively close to the ground and along canyon rims. At times, due to how and where these aircraft operate, there is a potential for conflict between the condors and these aircraft. Special care needs to be taken by agency personnel to be aware of the possibility that condors may be in the area. Several flight-path diversions of Grand Canyon National Park administrative helicopter flights have occurred due to the presence of condors in the air space.

Grand Canyon National Park has developed an observation record for the Fire and Aviation Program that records near misses and flight path diversions. Additional coordination protocols for helicopter activities in the Park could facilitate information exchange regarding the location of condors. A better system of recording condor activity and coordination with the air tour industry could be implemented to ensure not only the safety of the birds, but also of the aircraft.

On the Arizona Strip in June of 1998, while two BLM specialists were attempting to secure a cultural clearance for a new proposed California condor release site on the Hurricane Rim near Diamond Butte, two very low and fast-flying U.S. Air Force F-16s roared overhead. It turned out that the initially proposed site was directly under two existing military training routes (IR 126 and IR 266). The condor release site location was moved eight miles to the north. This incident called attention to the fact that a number of military aviation training routes exists in northern Arizona and southern Utah.

It is recommended that the Air Force be advised of all existing and future condor release sites, and possibly other condor concentration sites, in order to have these locations marked as hazards on military training route maps (specifically Department of Defense's flight planning publication AP/1B which is published twice annually).

Airborne Hunting Statute 16 USC 742j-1

> Prohibitions in this act that pertain to the condors include the use of "aircraft to harass any bird, to shoot or attempt to shoot any bird. Penalties include $5,000 fine and/or 1 year in jail. Forfeiture of all birds, fish or other animals shot or captured contrary to the provisions of this section… and all guns, aircraft, and other equipment used to aid in the shooting, capturing or harassing shall be subject to forfeiture to the United States."

There has been one incident regarding the harassment of condors by aircraft which resulted in a fine to a helicopter tour operator. In addition, military or civilian aircraft have either flown low near the condors or been spotted flying low over designated BLM wilderness areas and NPS administered areas. However, the observers have not always secured information necessary to identify the aircraft. It is further recommended that all condor field personnel report all potential condor/aviation incidents and be trained to record aircraft identification numbers, to be knowledgeable of wilderness or special land management aviation guidelines, and other pertinent information. A review with air tour operators should be conducted on an annual basis to ensure compliance with the Airborne Hunting Statute and potential violation of the ESA.

USDA APHIS-Wildlife Service's Activities

Periodically on lands administered by the BLM on the Arizona Strip (in Arizona north of the Colorado River), USDA APHIS-Wildlife Services has conducted preventive wildlife damage management. This work has consisted of coyote population suppression through the use of aerial gunning, chiefly in response to either predictable predator-caused livestock damage in late winter or to improve rates of pronghorn fawn survival in the spring. When discussing condor reintroduction efforts, predator control activities by Wildlife Services on the Arizona Strip has often been perceived as an issue (and was raised as part of the original 10(j) rule). Due to these concerns, Wildlife Services activities were carefully evaluated as part of the five-year review of the condor reintroduction program in northern Arizona. However, during the five-year period of actual experience, from December 1996, when the condors were reintroduced to January 2002, no conflicts between condors and Wildlife Services activities on BLM administered public lands on the Arizona Strip, or at other locations have been noted.

It is believed that all such activities on the BLM lands in the last five years have been in accordance with the national MOU between BLM and APHIS-Wildlife Services and the local work plan, as well as having been coordinated with the Arizona Game and Fish Department. Wildlife Services is not a party to the existing condor reintroduction MOU.

Since the first California condors were released in 1996, Wildlife Services has consistently contacted BLM prior to initiating their planned work on the Arizona Strip in order to accommodate BLM resource and safety management concerns. Special attention has been given to the condor reintroduction program. Wildlife Services personnel have also contacted The Peregrine Fund each time to ensure the condors were adequately protected.

The Wildlife Services aircraft, typically fixed-wing, used in aerial gunning fly close to the ground. Typically aerial gunning works best and is only applied in relatively large, flat, open, treeless expanses. It is not attempted in areas with significantly rough terrain or heavy vegetative cover. Certain areas near the condor release site on the Hurricane Rim were not flown by Wildlife Services in order to avoid any possible aerial conflict with the condors.

In addition, as the Wildlife Services aerial gunning program on the Arizona Strip employs only steel pellet shot fired from shotguns aboard the aerial platforms, there is no risk of lead poisoning from the aerial program. From the standpoint of protection of non-target species including the condor, it is felt that shooting is always far preferable to traps, snares, poisons, or M-44's because the human holding the gun can decide whether or not to pull the trigger. Inanimate devices such as those listed above do not make decisions; however, it should also be added that none of these devices are presently authorized for use on BLM public lands on the Arizona Strip.

Wildlife Services also calls and shoots by rifle some predators, chiefly coyotes, from the ground. While the rifle bullets used vary, they are generally small and fast copper-jacketed hollow point bullets that contain lead. (Predator calling and shooting by the public also occurs on BLM administered lands, usually during the winter months; it is believed that the kinds of bullets used by the public varies widely). A number of factors would influence the degree to which bullet or bullet fragments might be retained in coyote carcasses.

In 1999, because coyotes are scavengers as are condors and at BLM's urging, Wildlife Services, at no cost to BLM, had seven samples of coyote liver tissues collected on the Arizona Strip west of Kanab Creek analyzed for lead. Six of the seven had no detectable levels of liver lead concentration; one sample had 0.52 ppm (52 ug/dl). It would be good to do future additional sampling for lead on the Arizona Strip, perhaps at different times of the year.

The Grand Canyon-Parashant and the Vermilion Cliffs National Monuments were recently designated on the Arizona Strip. The Vermilion Cliffs National Monument in particular is often used by the condors and contains the primary release site. According to current BLM policy, Wildlife Services activities within the Monuments are limited to the taking of individual coyotes within the immediate vicinity after verified livestock kills, and no prophylactic measures to control coyotes are allowed. This policy essentially eliminates aerial gunning of coyotes within the Monuments.

There have also been additional efforts by Wildlife Services in the 10(j) area outside the Arizona Strip. For example, Wildlife Services has conducted aerial gunning operations for coyotes in the spring for three consecutive years north of Flagstaff in order to increase pronghorn fawn survival rates. Wildlife Services recently took a couple of problem mountain lions in the Mt. Elden area north of Flagstaff. To date, these areas are rarely used by the condors, some of the previous observations apply, and no condor concerns have been noted.

Efforts by Wildlife Services outside the existing 10(j) area but where condors may be found become more problematic. Several years ago in California, a condor was reportedly killed by a

M-44 device. Apparently two M-44 devices were set out approximately 30 feet apart. The first one attracted and killed a coyote, but the coyote moved close to the second device before it died. The condor was attracted to the body of the dead coyote and was killed by the second M-44. In Utah along the Green River and outside the 10(j) area, an environmental organization attempted to use the condors as a reason to prevent Wildlife Services from using M-44 devices.

Recognizing that Wildlife Services will continue to conduct predator control work where the reintroduced condors will be living, and that good communications between the Wildlife Services and the condor reintroduction program is essential, it is recommended that Wildlife Services be invited to become a condor program cooperator and party to any revised MOU.

Expansion of the Nonessential Experimental 10(j) Population Area

When the 10(j) rule was published in the Federal Register in October 1996 (61 FR 54044-54059), it was believed by most specialists involved that the designated area would be large enough to adequately contain the condor population. However, the discussion of issues within the Federal rule (Issue and Response 14; 61 FR 54055) acknowledged that should the designated area prove to be inadequate, FWS has the option to revise the rule to increase the size or change the configuration of the designated area. Also, as established in the "Implementation Agreement" with a coalition of county and local governments, FWS will relocate any California condors that move outside the experimental population area. By late 1996 (as the 10(j) rule was being finalized) the management advantages of the condor's nonessential experimental designation were quite apparent to community leaders in southern Utah who at the same time were frustrated with endangered species issues involving other listed species. The 10(j) designation was vital for local acceptance of the condor reintroduction program, making the release of an endangered species politically acceptable.

In July 1998, was the first known instance of a condor exceeding the designated nonessential experimental boundaries; within the next year there were several other instances to both the north and east outside the 10(j) area. The birds returned to the release area within a few days (see "Movements"). Additionally, when the second release site was proposed on the Hurricane Cliffs in 1998, only about 30 miles from St. George, Utah, and I-15 (the 10(j) boundary), the concern was raised that the birds would readily exceed the 10(j) boundary in Washington County, Utah. In order to allow the second release site to become politically feasible, FWS agreed that the 10(j) area would be proposed for expansion to included all of Utah. The intent of FWS and most cooperators is and has been since about 1997-98 to expand the existing nonessential experimental designation. However, even through the California Condor Recovery Team had twice recommended this expansion, it has been delayed due to various reasons (including FWS personnel changes, and unresolved efforts for assistance in completing the required environmental documentation prior to publication of the proposed rule).

While the condor reintroduction effort overall is working well, the delay by FWS to expand the 10(j) area was noted in several of the evaluation letters received, including those by two primary cooperators (AGFD and BLM), as well as by the Washington County Commission.

Because California condors released in northern Arizona have exceeded the nonessential experimental area by flying to Flaming Gorge, Wyoming; several points in central and western Utah; Grand Junction, Colorado; and, most recently, to Parker, Arizona (see "Movements"), expansion of the 10(j) area should include all of Arizona, Utah, Colorado, and at least a portion of Wyoming. In addition, while the condors in the Grand Canyon Ecosystem have not yet flown to New Mexico, the 10(j) area should also be expanded to include New Mexico in anticipation of wide-ranging condor flights following topographic features connecting an increasing Arizona population with New Mexico, and because New Mexico is being seriously considered as a condor release site to expand the southwestern condor population.

It is strongly recommended that the existing California condor nonessential experimental population area be broadly expanded as soon as possible. There is currently political support for this expansion within the State of Utah. The 10(j) expansion could be accomplished to include all five states in one Federal rule-making process, with measurable progress before the end of Fiscal Year 2002. However, if there is opposition to the expansion in certain areas which would significantly delay expanding the 10(j) area where immediately needed, then some commenters recommended FWS should secure the expansion of the 10(j) area in the states where it is possible to do so.

Critics of the nonessential experimental designation point out that condors inside the 10(j) area receive a reduced level of protection under the ESA. In practice, condor management is little affected by many existing land uses, and what may have been lost in regulatory application is more than made up for in positive acceptance and cooperation. Condors in northern Arizona spend a large proportion of time on National Park System lands where there is a higher level of protection under the 10(j) designation. In addition, during the five years of this reintroduction program, the lack of regulatory controls has not been demonstrated to be detrimental to the condor population. A very strong redeeming value of the condor program is that, by applying the 10(j) designation, the program in Arizona and Utah has only been used to save the condors, and not to advance (or be perceived to advance) other agendas. As condors range beyond the 10(j) boundary, there remains the risk of inappropriate application of regulatory issues.

It should be noted that the recommended broad expansion of the nonessential experimental area does not expand to the west where it may bring the condors from the southwest population into contact with the fully protected free-flying population in California. Maintaining geographically separate populations is required for an ESA 10(j) designation. While a portion of southern Nevada south and east of I-15 and US 95 is included in the existing experimental area, either a very limited or no expansion is suggested in Nevada.

Project Costs

Many of the personnel costs reported by agencies for the condor reintroduction program were provided as estimates. Often, the added workload associated with condors was generally absorbed into existing positions, with little or no increase in actual incurred costs. Nonetheless, the time allocated to the condor program by each agency reflects real costs.

No responses concerning any costs incurred due to condors were received from Glen Canyon National Recreation Area, the southwest Utah National Parks and Monuments, and USFS. The Southeast Utah Group of National Parks and Monuments reported that no additional funds have been spent in response to condor issues.

The AGFD reported the following expenditures through 1 December 2001:

Condor coordinator supported by Section 6 (75%) and AZ match (25%)	$189,506 [1]
Condor coordinator supported by Heritage Fund	$12,000
Nongame specialist supported by Heritage Fund (total of 0.93 FTE)	$40,700
Nongame birds program manager supported by Pittman-Robertson funds	$10,000
Chief of nongame and endangered wildlife supported by Arizona Nongame Wildlife Checkoff Fund	$5,000
Other Department personnel (e.g., law enforcement and public outreach) supported by State Game and Fish funds and Heritage Fund	$10,000
Total	**$267,206**

[1] FWS grants to states under section 6 of the ESA provided 75% of funding.

The BLM Arizona Strip Field Office reported the following expenditures:

Wildlife biologist (5 years @ 20% FTE per year)	$50,000
Transport of birds from captive rearing facilities ($5,000/yr)	$25,000
BLM aircraft from the National Interagency Fire Center for transport	NFR
Travel attending meetings and workshops	$10,000
Ceremony for first release	$10,000
Installation of informational kiosks	$8,500
Condor brochures	$2,500
Radios (three) for The Peregrine Fund	$2,800
Installation of "Bird Balls" in water tanks	$10,850
Installation of two Remote Automated Weather Stations (RAWS) atop Vermilion Cliffs	$30,000
Annual maintenance of two RAWS weather stations	$15,000
Total (conservative estimate)	**$164,650**

The FWS reported the following expenditures on the condor recovery program in northern Arizona for years 1995-2001 from Field, Regional, and Washington offices based on existing FTEs (does not include consultation or law enforcement activities):

Arizona Ecological Services Office total	2.18 FTE
Region 1 total	1.03 FTE
Region 2 total	0.12 FTE
Region 6 total	0.13 FTE

Washington Office total	0.05 FTE
Total	**3.51 FTE** [2]

[2] FWS funding under ESA section 6 grants to states, and congressional appropriations are included under AGFD and The Peregrine Fund, respectively.

Grand Canyon National Park reported the following expenditures:

Condor technician supported by Grand Canyon National Park Foundation and Grand Canyon Association funds	$39,000
Trailer rental space for The Peregrine Fund supported by Grand Canyon National Park Fee Demo (20%) funds	$3,000
Travel for a certified radiation officer to assist in affixing deterrents to the Orphan Mine tower structure	$3,000
Wildlife biologist and wildlife program manager	$28,000
Total estimated trough FY 2002	**$78,000**

Jacob Lake Inn reported the following expenditures:

Space for living accommodations for The Peregrine Fund monitoring personnel	NFR
Water and sewage disposal hookups	NFR
Horse killed when a news helicopter panicked it during early publicity	$2,200
Lost isolation and privacy	NFR
Travel to testify in favor of reintroduction	$500
Total	**$2,700**

Arizona Public Service utility company reported the following expenditures:

Installation of raptor protection devices on utility lines and poles	$32,939
Total	**$32,939**

The Peregrine Fund reported the following expenditures:

Operating expenses for fiscal years 1993 through 2001 for condor reintroduction program in northern Arizona	$4,486,242 [3]
Total	**$4,486,242**

[3] FWS pass through of congressionally appropriated funds approximately $2,817,000

FTE = full time equivalent
NFR = no monetary figure reported

Research Needs

It is critical that the ecological aspects of the condor recovery efforts be given high priority. It is not merely enough to "preserve" the species--we must examine and collect the appropriate data on distribution, abundance, and ecological relationships of the California condor. We must ensure that survival, reproduction, and recruitment are stable in order to reach a long-term goal of a viable, self-sustaining population of condors in the wild.

On the Colorado Plateau, there are many information needs pertaining to the biology of the condor. Major research endeavors require a detailed study plan and careful experimental design to obtain meaningful results. Research priorities and expenditure of limited financial resources and field biologist time must be determined in coordination with local information needs and overall condor recovery program issues. The next five years could focus on obtaining various types of scientific information, with an emphasis on that data necessary to make informed management decisions. The Arizona Working Group and California Condor Recovery Team should be included in prioritizing research needs and approaches. The current gap in data that could be addressed includes the following:

- Collect information on bird flight corridors, activity areas and flight elevation. This can be achieved through extensive use of satellite telemetry, GPS data recorders, and traditional telemetry devices.

- Collect information on prey base distribution, seasonality, cause of death, and abundance.

- Assess toxicity of copper-jacketed bullets; determine toxicity levels by analyzing tissue sample of non-target scavengers. Assess exposure potential and pathways of lead in the environment.

- Behavioral information that could be useful as the reintroduction expands includes: pair bond formation, flock social structure and dominance hierarchy, and dispersal and foraging patterns.

- Collect habitat use information: nesting, roosting, and perching preference.

- Collect information on interspecies relationships (turkey vultures, zone-tail hawks, peregrine falcons, golden eagles).

- Document potential nest-predator interactions (e.g., ravens, coyotes, ringtails).

- Collect all nest site information (e.g., cave/ledge length, width, aspect).

- In relation to aircraft overflights and condors, collect data on the following:
  - Determine the general flight corridors used by condors.
  - Aircraft/animal relationships.
  - Define bird responses to overflights.
  - Tolerance of condors to overflights.
  - Biotic factors.
  - Behavioral responses.
  - Effects of disturbance on habitat use.
  - Duration of animal responses to aircraft.
  - Long-term or large-scale effects.
  - Determine how aircraft are perceived.

- Data should also be collected regarding impacts from recreational activities:
  - Define responses to recreational use on animal physiology, sound and hearing.
  - Tolerance to recreation.
  - Biotic factors.
  - Behavioral responses.
  - Effects of disturbance on habitat use.
  - Duration of animal responses to recreational use.
  - Long-term or large-scale effects.

Accomplishment of Recovery Tasks

The recovery strategy for the California condor is to focus on: 1) increasing reproduction in captivity to provide condors for release; 2) releasing condors to the wild (to establish two geographically separate, self-sustaining, free-flying condor populations); 3) minimizing condor mortality factors; 4) maintaining habitat for condor recovery; and 5) implementing condor information and education programs (FWS 1996). With the reintroduction of California condors in northern Arizona, number 2 has been initiated. As discussed in several sections throughout this report, a variety of actions associated with the reintroduction of condors in northern Arizona have implemented numbers 3 and 5.

The recovery outline of the recovery plan includes several tasks to be completed or implemented. The following specific tasks from that outline have been accomplished with the reintroduction of condors in northern Arizona.

2. Reintroduce California Condors to the Wild

    24. Following the procedures outlined in tasks 21 through 23, implement releases of California condors outside California.

        241. Release California condors in northern Arizona.

4. Minimize Mortality Factors in the Natural Environment.

45. Monitor contaminant levels in California condors.

5. Implement Information and Education Programs on Condor Habitat Use and protection Needs.

54. Establish observation points and educational facilities at selected sites.

Attaining a successful reintroduced population of California condors in Arizona (including the southwestern United States) is essential to meet the species' recovery plan objectives.

CONCLUSIONS and RECOMMENDATIONS

The review team, and those agencies, organizations, and individuals who participated in the review of the first five years of the California condor reintroduction program in northern Arizona, have expressed a very high level of satisfaction with the reintroduction program. Several issues of coordination, communication, and management have been identified where there could be some improvement, but no agency, organization, local governmental group, local land owner, or other private individual has recommended termination of the condor reintroduction efforts.

Overall, the California condor reintroduction program in northern Arizona after the first five years is widely considered to be an unprecedented success. With the laying of an condor egg in the wild in 2001, expectations are high that a chick may be successfully raised in the wild in 2002. But there have been setbacks. With each new challenge (e.g., deaths, inappropriate behavior, poisonings), actions to address the problem were identified and incorporated into condor management decisions. Adaptive management, learning from each challenge, and then moving forward, is truly a critical aspect of this *experiment* in the reintroduction of condors to the wild. The nonessential experimental rule provided direction to seriously consider terminating the program if condor mortality rates are at 40 percent or greater, or released condors are not finding food on their own. Following the release of 47 condors over five years in northern Arizona, the mortality rate of this primarily immature population of released condors is very close to 40 percent. This report fully discloses the causes and circumstances of condor deaths and the resulting management actions, including modifying feeding strategies. These mortalities were not the result of relaxed regulations under the nonessential experimental rule. As the condor population matures and by applying adaptive management concepts, future losses may be minimized. The issues of mortality rate and wild foraging are considered to be adequately addressed.

The review team would like to acknowledge the tremendous efforts of The Peregrine Fund, and especially field personnel, in carrying out the reintroduction of condors in northern Arizona. The participation in the program by AGFD, BLM, NPS, and FWS has greatly contributed to its overall success. There has been an enthusiastic acceptance of the condor reintroduction program by the public, including in local communities, with support provided by local land owners and businesses. The consistent adherence by regulatory agencies to the obligations provided through the nonessential experimental rule (that no changes in land use practices occur due to the presence of condors), has been an important part of gaining local support for the program. The ultimate success of California condor recovery in the southwest is dependant on the continued acceptance and support of the program by local communities, and will require a long-term commitment and active participation by many agencies and organizations in Arizona and Utah, and perhaps other states.

The review team unanimously recommends to the California Condor Recovery Team and FWS, the continuation of the California condor reintroduction program in northern Arizona. However, this review of the first five years of the reintroduction program brought to light several issues that need to be addressed in order to increase the effectiveness of the program. The following recommendations are provided for consideration by all cooperators. Additional detail is included in the main body of this report. The Arizona Condor Working Group and The Peregrine Fund, in coordination with the overall condor recovery program, can address the details, costs, and priority of these recommendations.

Administration and Coordination Recommendations

- Proceed with the process to broadly expand the nonessential experimental area designation.

- Secure all permits as required by management agencies.

- Develop a new MOU among all program cooperators, clearly defining roles and expectations. Conduct at least one annual meeting for all program cooperators.

- Improve coordination and develop stronger partnerships with:
  - Tribes located in northern Arizona
  - Kaibab National Forest
  - Utah Division of Natural Resources
  - Land management agencies in Utah (NPS units; national forests, BLM)
  - USDA APHIS-Wildlife Services

- Develop law enforcement coordination protocols.

- Identify opportunities for increased public education about condors and the reintroduction program.

- Encourage/support development and commercial availability of non-toxic ammunition.

- Initiate a hunter awareness program regarding the threat of lead poisoning to condors by ingestion of bullet fragments from animal carcasses.

- Initiate investigations into the pathways of lead in the environment (identify potential lead exposure sources, and its distribution and abundance).

- Continue coordination with utility companies and marking of transmission lines in critical locations.

- Coordinate with federal management agencies concerning their responsibilities under section 7 of the ESA, and the provisions of the nonessential experimental rule.

Field Management Recommendations

- Continue management flexibility to rapidly respond to new challenges through adaptive management.

- Continue intensive monitoring and individual bird assessments (e.g., location; roost sites; health and behavior assessments, including blood lead testing), especially for the first 60 to 90 days following release.

- Establish a medical treatment facility near the release site(s).

- Expand on the use of satellite telemetry and other remote location data recorders (e.g., GPS units).

- Intervene (e.g., hazing; capture) as soon as possible to prevent a bird from being compromised due to behavioral or health reasons; to remove a problem bird from the population; or to preclude a problem situation from developing (e.g., placement of perching deterrents).

- Continue to hold birds in the flight pen longer than the six month natural fledging age.

- Increase the use of adult condor mentors while holding juvenile birds in the flight pen.

- Continue providing contaminate free carcasses and feeding site management, including disposal of the remains of proffered carcasses.

- Develop data management procedures for consistency in recording observations, and prompt entry of data for computerized data storage, organized retrieval, and analysis. Field biologists should be allocated time for data transcription as part of their daily assignments.

- Prioritize research needs and make all data available to program cooperators for research, peer review, and management decisions.

- Identify condor movement patters and flight corridors.

- Expose young birds to large carcasses as early as possible.

- Aggressively manage and document condor nesting activities.

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Appendix A. Time line of California condors reintroduction to northern Arizona (modified from The Peregrine Fund 2001 Annual Report to FWS).

October 1996:	The section 10(j) rule of the Endangered Species Act was published in The Federal Register, and a lawsuit filed by San Juan County in southern Utah was dismissed, giving the green light for the release to take place.
October 29, 1996:	Six parent-reared California Condors were flown from Burbank, California to Page, Arizona on a C26A smoke jumper plane supplied by the Bureau of Land Management. The six condors were then flown to the release site above the Vermilion Cliffs by The Salt River Project helicopter.
December 12, 1996:	Hundreds of California Condor enthusiasts gathered below the Vermilion Cliffs to witness the release of six condors.
January 10, 1997:	The body of Condor 142 was found dead below the Vermilion Cliffs, apparently killed by a Golden Eagle.
May 18, 1997:	The body of Condor 151 was found below a span of high power lines southeast of Page, Arizona. The condor died shortly afterwards from injuries sustained from the collision with the line.
April 29, 1997:	Nine California Condors, hatched between March 15, 1995 and May 20, 1995, were flown from the Los Angeles Zoo to Page, Arizona by the Bureau of Land Management and transported to the release site above the Vermilion Cliffs.
May 14, 1997:	The first four of the nine condors were released.
May 26, 1997:	The second group of five condors were released, bringing the total of free-flying California Condors in Arizona to 13.
July 13, 1997:	Condor 126 had to be captured and sent back to the World Center for Birds of Prey in Boise, Idaho. It was determined that her tameness towards humans might jeopardize the behavior of the other condors.
July 14, 1997:	Condor 128 left the area with Condors 122 and 127, and was never seen again. Numerous flights were taken in order to try to pick up a radio signal but were abandoned by the end of August. We are now counting the bird as a mortality.

July 20, 1997: Condor 124 was captured at the visitors' center on the South Rim of the Grand Canyon National Park. She had last been seen feeding 26 days before. She was given emergency medical assistance and sent to the San Diego Wild Animal Park where she recovered. She has since been re-released at the Vermilion Cliffs and is doing well.

October 8, 1997: Four additional puppet-reared condors were flown from the Los Angeles Zoo to Page, Arizona by the BLM smoke jumper plane from Boise, Idaho. They were picked up by The Salt River Helicopter and flown to the release site.

November 20, 1997: The four young Condors were released from the Vermilion Cliffs release site.

November 25, 1997: The Boise Air National Guard flew a C-130 transport plane to Miramar Air Force Base near San Diego and picked up seven condors from the San Diego Wild Animal Park. It then flew to Burbank where 13 additional condors were picked up from the Los Angeles Zoo. All 20 birds were flown to the Peregrine Fund's new condor facility in Boise, bringing the Boise captive population to 41 individuals. The 20 new birds ranged from three to seven years of age.

July 31-
August 13, 1998: Condor 119 disappeared and flew 310 miles north before being spotted at Flaming Gorge Reservoir on the Wyoming/Utah border before returning to the site on August 13.

August 23-27, 1998: Condors 116, 122, and 123 left the release area on August 23, and were spotted on August 25 near Grand Junction, Colorado over 250 miles to the north. They returned to the Vermilion Cliffs in just one day on August 27.

September 25, 1998: The final approval had been given to establish a second California Condor release site on the Hurricane Cliffs approximately 65 miles to the west of the Vermilion Cliffs release site and construction began on the enclosed 8 foot by 24 foot enclosed hack box and 24 foot by 30 foot attached fly pen.

October 3, 1998: The carcass of California Condor #169 was found.

October 7, 1998: The BLM smoke jumper plane in Boise flew six young California Condors from Boise, Idaho to St. George, Utah and then proceeded to Burbank, California. The six young condors were driven to the new Hurricane Cliffs site.

October 8, 1998: Three additional California Condors were flown from the Los Angeles Zoo to St. George, Utah and transported to the new Hurricane Cliffs site, bringing the total to nine new birds, giving Arizona a total of 23 condors.

November 18, 1998: The eight young condors were released from the Hurricane Cliffs site.

November 23, 1998: The single condor, #134, produced in 1996 was released from the Vermilion Cliffs release site.

December 24, 1998: Condor 177, released on November 18, was found dead near the release site, presumably killed by a coyote.

March 11, 1999: Condor 124 was found shot and killed in the Grand Canyon. A young man turned himself in and was subsequently fined $3,200 by the FWS.

May 6, 1999: Condor 186 was captured and returned to Boise after repeatedly approaching people and showing signs of being too tame.

November 8, 1999: Nine condors were flown from Boise, Idaho to St. George, Utah. The birds were then driven to the Hurricane Cliffs release site.

December 7-29, 1999: Seven of the nine condors at the Hurricane Cliffs site were released. One was returned to Boise for future release and four year old condor 129 was released at the Vermilion Cliffs.

January 5, 2000: Condor 207 found dead near Hurricane release site from aspirating food.

February 4, 2000: Condor 197 found dead near Hurricane release site from eagle predation.

March 3, 2000: Condor 116 found dead above Colorado River from lead poisoning. All of the condors were trapped and tested for lead. Only 119 had high levels and was treated and released.

April 11-14, 2000: Condors 195,196, 198 and 203 were captured for behavioral reasons and returned to Boise.

May 1, 2000: Condor 111 missing and presumed dead.

June 12, 2000: Condor 165 found dead below south rim of Grand Canyon from lead poisoning.

June 16, 2000: Condor 191 died at the Phoenix Zoo from lead poisoning.

June 20, 2000: Condor 182 found dead near the Vermilion Cliffs, cause unknown. Condor 150's telemetry signal found stationary over several weeks in an inaccessible area of canyon–cause of death unknown. All but one of the birds were captured and tested for lead. Nine had unacceptable levels over 50 ug/dl and were treated and released over a period of two months.

September 7, 2000: Condor 184 found dead below the Vermilion Cliffs, presumably from eagle predation.

November 8, 2000: Thirteen condors were flown from Boise, Idaho to Marble Canyon, Arizona by the USFS with funding from the BLM.

December 7, 2000: The first pair of adult nine year old condors, 82 and 74 were released in the experiment to accelerate having birds breeding in the wild at an earlier date.

December 19, 2000: The second pair of adult 10 year old condors, 70 and 60 were released.

December 25, 2000: Adult condor 82 found killed by coyotes.

December 28, 2000: Adult condor 74 was found killed by coyotes and the remaining adult pair 70 and 60 were immediately caught and brought back into captivity ending the experiment.

December 29, 2000: The remaining seven young and two older birds were released from the Vermilion Cliffs release site.

January 31, 2001: Condor 232 was temporarily brought back into captivity for behavioral reasons.

February 9, 2001: Young Condor 228 was found dead and emaciated on top of hack box.

March 25, 2001: First California Condor egg laid in the wild by captive released condors was found in Grand Canyon National Park. It was broken by the condors on the same day.

May 14, 2001: Young condors 232 and 224 were temporarily brought back into captivity for behavioral reasons.

May 23, 2001: Condor 186 was temporarily brought back into captivity for behavioral reasons.

August 24, 2001: The first satellite transmitter placed on a condor in Arizona was placed on condor 176.

Appendix B. California condor releases in northern Arizona (modified from The Peregrine Fund Annual Report, 2001). LAZ = Los Angeles Zoo; SDWAP = San Diego Wild Animal Park; WCBP = World Center for Birds of Prey, Boise, Idaho.

Release 1. Vermilion Cliffs, 12 December 1996. Birds transferred to site 28 October 1996.

Condor	Sex	Breeding Facility Rearing Method	Hatch Date	Status as of 31 Jan 2002
133	F	LAZ Parent	22 May 1996	Free-flying
136	F	LAZ Parent	12 May 1996	Free-flying
142	M	LAZ Parent	29 May 1996	Dead - 10 Jan 1997 Golden eagle
149	F	LAZ Parent	7 May 1996	Free-flying
150	F	WCBP Parent	26 May 1996	Dead - June 2000 Unknown
151	F	LAZ Puppet	2 June 1996	Dead - 18 May 1997 Transmission line collision

Release 2. Vermilion Cliffs, 14 May 1997. Birds transferred to site 29 April 1997.

Condor	Sex	Breeding Facility Rearing Method	Hatch Date	Status as of 31 Jan 2002
116	M	SDWAP Puppet	13 April 1995	Dead - 2 Mar 2000 Lead poisoning
119	F	SDWAP Puppet	15 Mar 1995	Free-flying
127	F	SDWAP Puppet	31 Mar 1995	Free-flying
128	F	LAZ Puppet	19 April 1995	Dead - 14 July 1997 Lost

Release 3. Vermilion Cliffs, 26 May 1997.
Birds transferred to site 29 April 1997.

Condor	Sex	Breeding Facility Rearing Method	Hatch Date	Status as of 31 Jan 2002
114	M	SDWAP Puppet	9 April 1995	Free-flying
122	M	LAZ Puppet	17 May 1995	Free-flying
123	M	LAZ Puppet	20 May 1995	Free-flying
124	F	LAZ Puppet	4 April 1995	Dead - 10 Mar 1999 Shot
126	F	SDWAP Puppet	2 May 1995	Free-flying

Release 4. Vermilion Cliffs, 20 November 1997.
Birds transferred to site 8 October 1997.

Condor	Sex	Breeding Facility Rearing Method	Hatch Date	Status as of 31 Jan 2002
158	M	SDWAP Puppet	7 April 1997	Free-flying
162	M	LAZ Puppet	14 April 1997	Free-flying
165	M	WCBP Puppet	20 April 1997	Dead - 12 June 2000 Lead poisoning: 17 shot pellets in crop
169	M	SDWAP Puppet	20 May 1997	Dead - 3 Oct 1998 Coyote

Release 5. Hurricane Cliffs, 18 November 1998.
Birds transferred to site 7 and 8 October 1998.

Condor	Sex	Breeding Facility Rearing Method	Hatch Date	Status as of 31 Jan 2002
134	M	SDWAP Puppet	2 April 1996	Free-flying
176	F	WCBP Puppet	19 Mar 1998	Free-flying
177	M	WCBP Puppet	28 Mar 1998	Dead - 24 Dec 1998 Coyote
182	F	WCBP Puppet	2 April 1998	Dead - 20 June 2000 Unknown
184	F	LAZ Puppet	11 April 1998	Dead - 7 Sept 2000 Golden eagle
186	M	LAZ Puppet	15 April 1998	Free-flying
187	M	WCBP Parent	22 April 1998	Free-flying
191	F	WCBP Parent	10 May 1998	Dead - 16 June 2000 Lead poisoning
193	M	WCBP Puppet	30 May 1998	Free-flying

Release 6. Hurricane Cliffs, 7 December 1999.
Birds transferred to site 8 November 1999.

Condor	Sex	Breeding Facility Rearing Method	Hatch Date	Status as of 31 Jan 2002
195	F	SDWAP Puppet	19 Feb 1999	Captivity - WCBP
196	F	SDWAP Puppet	20 Mar 1999	Free-flying
197	F	SDWAP Puppet	24 Mar 1999	Dead - 4 Feb 2000 Golden eagle
198	M	SDWAP Puppet	31 Mar 1999	Free-flying
203	M	WCBP Puppet	23 April 1999	Free-flying
207	M	WCBP Parent	4 May 1999	Dead - 15 Jan 2000 Aspiration
211	F	WCBP Parent	23 May 1999	Dead - May 2000 Missing

Release 7. Vermilion Cliffs, 7 December 2000.
Birds transferred to site 8 November 2000.

Condor	Sex	Breeding Facility Rearing Method	Hatch Date	Status as of 31 Jan 2002
74	M	LAZ Puppet	20 May 1992	Dead - 28 Dec 2000 Coyote
82	F	SDWAP Puppet	4 April 1992	Dead - 25 Dec 2000 Coyote

Release 8. Vermilion Cliffs, 19 December 2000.
Birds transferred to site 8 November 2000.

Condor	Sex	Breeding Facility Rearing Method	Hatch Date	Status as of 31 Jan 2002
60	M	LAZ Puppet	30 Mar 1991	Captivity - WCBP
70	F	LAZ Puppet	25 May 1991	Captivity - WCBP

Release 9. Vermilion Cliffs, 29 December 2000.
Birds transferred to site 8 November 2000.

Condor	Sex	Breeding Facility Rearing Method	Hatch Date	Status as of 31 Jan 2002
210	F	WCBP Puppet	23 May 1999	Free-flying
223	M	WCBP Puppet	. 18 April 2000	Free-flying
224	F	WCBP Puppet	18 April 2000	Free-flying
227	M	WCBP Puppet	28 April 2000	Free-flying
228	F	WCBP Parent	28 April 2000	Dead - 9 Feb 2001 Starvation
232	M	WCBP Puppet	30 April 2000	Captivity - WCBP
234	F	WCBP Puppet	11 May 2001	Free-flying
235	F	WCBP Parent	18 May 2001	Free-flying

Appendix C. California condor five-year review open houses public comments and summary of issues from comment letters.

Public Open House, 1 November 2001, Kanab, Utah

a. Status of 10J expansion in Utah West of I-15.
b. Impact to local economy
c. How to cope with close encounters with Condors.
d. "Natural" mortality should not count towards 40% threshold (over 5 year period).
e. Natural mortality in juvenile raptors much higher than 40%.
f. West Nile Virus and other disease threats.
g. Need to give more public presentations locally, including schools.
h. Cost of program.
i. Contact local tourism industry to gauge level of interest.

Public Open House, 5 November 2001, Flagstaff, Arizona

1. Should expect mortality to begin higher; unanticipated events; learning curve.
2. Program extremely successful (at least in captivity) which should balance out with higher mortality in wild.
3. The whole idea is to have a population in the wild and not in captivity so need to keep trying.
4. Don't stop no matter what the numbers.
5. Break out "natural" vs. man-caused mortality.
6. Mortalities have taught us a lot.
7. We've saved a lot of birds (chelation, teaching aversion to dogs/perching on ground).
8. Once reproduce, expect parents to teach young about a lot of these hazards.
9. How will Condor be treated in BLM/NPS monuments (10J or Th)?
10. Public education re lead issue/hazard.
11. Lead exposure is manageable at this point although we don't know what the lasting effects may be.
12. We may want to <u>invite</u> people to future releases (like did 1st time) to foster interest and support.
13. Generally, Flagstaff is interested and approves of project.
14. Navajo activists would probably have positive input.
15. Hold one of these (in future?) meetings in Cameron or place closer to Navajo Nation and other tribal residents.

All comments received at the public open houses or otherwise received fall into 8 broad topics.

2. Status of 10(j) expansion.
2. Condor mortality rate.
3. Program costs.
4. Impact to local economy.
5. Education about program (how to behave around a condor, what to do/who to call; school programs) and about lead.
6. Public acceptance and interest.
7. Outreach to communities that haven't shown as much interest (e.g., tribes).
8. Disease threats.

EXHIBIT 2

A Review of the Second Five Years of the California Condor Reintroduction Program in the Southwest

April 2007

Review of the Second Five Years of the California Condor Reintroduction Program in the Southwest

List of Preparers

This report is prepared for the California Condor Recovery Team and U.S. Fish and Wildlife Service, California/Nevada Operations Office, Sacramento, California, in fulfillment of the requirements of the Federal rule (61 FR 54044-54059) allowing for the reintroduction of California condors under a nonessential experimental designation in northern Arizona and southern Utah.

Prepared by the Southwest Condor Review Team:

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The cover photograph in this report is by and courtesy of Chris Parish of The Peregrine Fund. For copies, contact Chris at cparish@peregrinefund.org.

Disclaimer

References to manufacturers, products, and brand and trade names do not imply endorsement by the preparers, the Southwest Condor Working Group, or the United States government.

List of Acronyms and Terms Used in this Report

µg/dl	micrograms per deciliter
10(j) area	(Northern Arizona) Nonessential Experimental Population Area
AGFD	Arizona Game and Fish Department
AOU	American Ornithologists Union
APHIS	Animal and Plant Health Inspection Service
ASDO	Arizona Strip District Office
BLM	Bureau of Land Management
DVM	Doctor of Veterinary Medicine
EA	Environmental Assessment
ESA	Endangered Species Act
FAA	Federal Aviation Administration
FR	Federal Register
FWS	U.S. Fish and Wildlife Service
GLCA	Glen Canyon National Recreation Area
GRCA	Grand Canyon National Park
MOU	Memorandum of Understanding
NEPA	National Environmental Policy Act
NPS	National Park Service
PTT	Platform Terminal Transmitter
SCWG	Southwest Condor Working Group
TPF	The Peregrine Fund
UDWR	Utah Division of Wildlife Resources
USDA	U.S. Department of Agriculture
USFS	U.S. Forest Service
VHF	Very High Frequency
WMI	Wildlife Management Institute
WNV	West Nile Virus
WS	USDA APHIS Wildlife Services

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A Review of the Second Five Years of the California Condor Reintroduction Program in the Southwest

INTRODUCTION

At the end of 2006, the U.S. Fish and Wildlife Service (FWS) completed the tenth year of releases of California condors (*Gymnogyps californianus*) in northern Arizona. This reintroduction is conducted under a special provision of the Endangered Species Act (ESA) that allows for the designation of a "nonessential experimental" population. Under this designation [often referred to as the "10(j) rule" or "10(j) area" for the section of the ESA allowing this provision] the protections for an endangered species are relaxed, providing greater flexibility for management of a reintroduction program. As part of the Federal rule-making process that established the nonessential experimental designation (61 Federal Register 54044-54059; 16 October 1996), the FWS agreed to a formal evaluation of the progress and public acceptance of this reintroduction within the first five years of the program, and every five years thereafter. In addition to the final rule establishing the nonessential experimental designation, FWS entered into a "Memorandum of Understanding" (MOU) with various cooperators, including state and Federal agencies, Native American nations, and private organizations, and an "Implementation Agreement with Local Governments." These documents outlined commitments by FWS and cooperators in the implementation of the condor reintroduction program, and the application of Federal regulation. This report evaluates the progress of the condor reintroduction program in the Southwest and compliance with the established commitments for the second five-year period (2002-06) of the program.

BACKGROUND

The program of releasing California condors in the Southwest includes northern Arizona and southern Utah and has been entered into by the FWS as a partnership among various Federal agencies [primarily: Bureau of Land Management (BLM); National Park Service (NPS); U.S. Forest Service (USFS)] and state agencies [primarily: Arizona Game and Fish Department (AGFD) and Utah Division of Wildlife Resources (UDWR)], and The Peregrine Fund (TPF), a private/nonprofit organization. TPF manages the day-to-day operations of the field program, including release, monitoring the birds' movements, working with local land owners and land managers, and providing any additional care for the birds. TPF also maintains a condor breeding facility at the World Center for Birds of Prey in Boise, Idaho. Representatives of these agencies and organizations, together with others identified in the interagency MOU, form the Southwest

Condor Working Group (SCWG), facilitating coordination among the agencies and organizations. The MOU was updated in 2005 (see the Coordination Among Program Cooperators and Compliance with Commitments section).

The first condor release in northern Arizona occurred on December 12, 1996. A total of 93 condors were released to the wild and five were wild-hatched in northern Arizona by the end of 2006. Reintroduction efforts have been complicated by predation, lead poisonings, condor-human interactions, and shootings. Thirty-seven of the released birds and one of the wild-hatched birds have died. Three released individuals were returned to captivity. One of those individuals was returned in an effort to maintain the optimum genetic representation in the breeding flock. The other two (which were released as adults as part of an experiment) were returned to captivity due to lack of awareness of ground-based predators.

In March 2001, a reintroduced condor produced the first confirmed condor egg laid in the wild since 1986. The egg was laid in a shallow cave in Grand Canyon National Park (GRCA). Egg production continued with contributions from two pairs of condors in 2002, three pairs in 2003, two pairs in 2004, two pairs in 2005 and three pairs in 2006. Those reproductive efforts resulted in one wild-fledged individual in 2003, two in 2004, and two in 2005. After ten years of the release program, there are 57 free-flying condors in northern Arizona, including four produced in the wild.

The nonessential experimental population status applies to condors only when they are within the geographic bounds of the designated 10(j) area of the Southwest, which is defined by: Interstate Highway 40 on the south, U.S. Highway 191 on the east (parallel to the New Mexico and Colorado state borders), Interstate Highway 70 on the north, and Interstate Highway 15 to U.S. Highway 93 near Las Vegas, Nevada on the west (Figure 1). When condors leave this area they receive full protection of the ESA, which may have regulatory implications. The condors have been known to fly widely, but generally remain within the Grand Canyon Ecoregion/Colorado River corridor. Early in the program, condors left the nonessential experimental area on several occasions, flying as far as Flaming Gorge, Wyoming (310 miles from the release site), and Grand Junction, Colorado (approximately 250 miles from the release site). All of the far-wandering condors returned to the release area on their own.

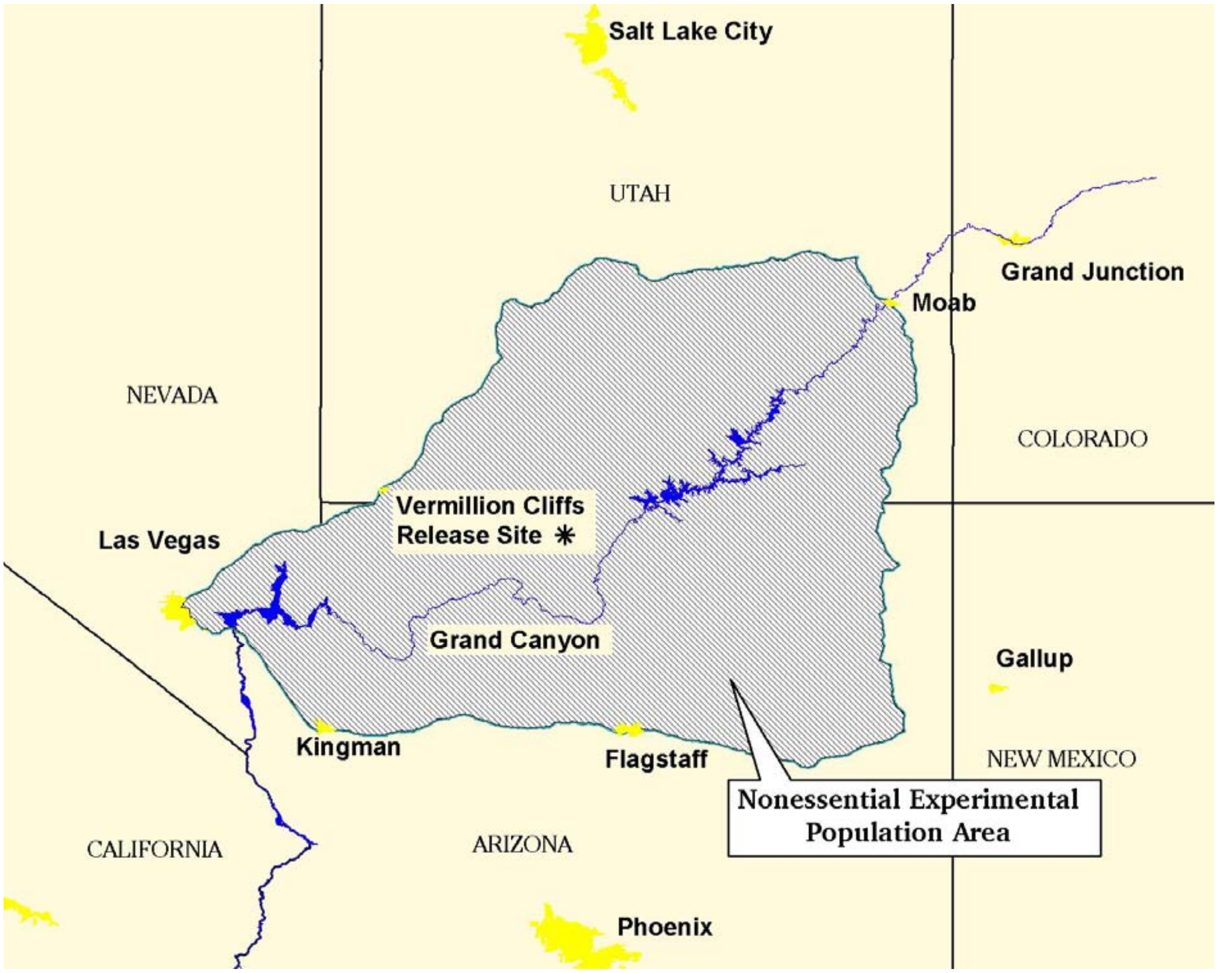

Figure 1. California condor nonessential experimental population area of the Southwest.

Condor activity in southwestern Utah has increased considerably over the past three years (2004-06). Groups of condors now regularly reside in Utah from April through November. Breeding in the area is anticipated in coming years.

REVIEW PROCESS

This review was conducted by the Southwest Condor Review Team (referred to within this report as the review team) that included condor biologists, representatives of local land and wildlife management agencies, the SCWG, and FWS, with input from local governments and the public. This report, prepared by the review team, is submitted to the California/Nevada Operations Office which is the lead for the California condor program. That FWS lead will coordinate any further action with the California Condor Recovery Team which is an advisory panel of scientists providing support to FWS. The FWS is responsible for making the final decision regarding the continuation of this reintroduction program and adoption of recommendations. This process fulfills the five-year review requirement for the second five-year period as stated in the final rule establishing the nonessential experimental population of California condors in northern Arizona.

The guidelines under which the review was conducted come from the final rule establishing the nonessential experimental designation:

> Final Rule, Endangered Species Act, Section 10(j) (61 FR 54044-54059). Special Rule 10, p. 54058. *(10) The status of the reintroduction project is to receive an informal review on an annual basis and a formal evaluation within the first 5 years after the initial release, and every 5 years thereafter. This evaluation will include, but not be limited to: a review of management issues; compliance with agreements; assessment of available carrion; dependence of older condors on supplemental food sources; post release behavior; causes and rates of mortality; alternative release sites; project costs; public acceptance; and accomplishment of recovery tasks prescribed in California Condor Recovery Plan. The number of variables that could affect this reintroduction project makes it difficult to develop criteria for success or failure after 5 years. However, if after 5 years the project is experiencing a 40 percent or greater mortality rate or released condors are not finding food on their own, serious consideration will be given to terminating the project.*

The review guidance from the final rule basically poses two questions: 1) have condors been provided a reasonable opportunity for survival, and not put at too great a risk due to either ecological factors or a lack of protections of the ESA under the nonessential experimental designation? and 2) did the FWS and other agencies comply with their various commitments regarding the application/relaxation of Federal regulation?

This report examines each of the major issues brought forward from comments from the public or identified by review team members, in the context of the review guidelines from the final rule. In addition, issues addressed in the final rule are re-assessed. Each topic is individually addressed, and grouped in one of two broad categories: biology and management, or administration. Recommendations to improve the effectiveness of the program are included.

PUBLIC PARTICIPATION

The review team sought to include broad participation in the review process. The team solicited comments and participation in the review from government agencies, Tribes, business owners, environmental and industry groups and local individuals, and condor and endangered species experts that have expressed interest or participated in the reintroduction program. Additionally, more general advertisement of the review was conducted in the northern Arizona and southern Utah news media markets.

Notification was provided through direct mailing (>100 addresses), email (>150 addresses), website posting (www.fws.gov/southwest/es/arizona/) and news releases sent to 62 news outlets (predominantly print and radio in northern Arizona, southern Utah and southeastern Nevada). A number of media outlets in southern Utah and northern Arizona published notices or broadcast information about the review.

Detailed information regarding topics upon which comments could be formulated was provided upon request and was made available through four relevant websites: www.peregrinefund.org/released_condorsinfo.asp, www.fws.gov/arizonaes/, www.fws.gov/southwest/es/arizona/CA_Condor.htm, and www.azgfd.gov/condor. Because the team received a number of comments that referenced information from these websites, we know that this method of distributing information was effective. Team members also distributed handouts at open houses summarizing aspects of the condor reintroduction program and the five-year review process.

The review team hosted two public open houses, one in Kanab, Utah, on October 3, 2006, 7-9 p.m. at the Grand Staircase Escalante National Monument - Kanab Visitor Center, 745 East Highway 89; and one in Flagstaff, Arizona, on October 4, 2006, 7-9 p.m. at the Arizona Game and Fish Department Office, 3500 South Lake Mary Road. Twelve attendees registered at the Kanab meeting and ten registered at the Flagstaff meeting. At each open house, the team members provided a review of the California condor reintroduction program since January 2002, and open house participants provided questions, concerns, and comments orally or in writing. We also recorded oral comments and responses to questions for consideration and inclusion in this five-year review. A summary of comments and discussion from the open houses and those received by mail and email is provided in Appendix A.

Requests for comments were solicited starting on September 1, 2006, and accepted through October 31, 2006. Public and agency input was received via direct mail, email, telephone, and in-person at open houses. Written comments and the list of public open house attendees are included in the administrative record and are available for inspection by appointment at the Arizona Ecological Service Field Office, 2321 W. Royal Palm Road, Suite 103, Phoenix, Arizona, 85021, (phone: (602) 242-0210).

BIOLOGY AND MANAGEMENT

Release Strategies

During the five years of this reporting period (2002-06), the status of condor restoration in Arizona has undergone considerable development. Most encouraging has been the establishment of successfully reproducing condor pairs, a substantial increase in the overall number of free-ranging condors, and a dramatic range extension into southern Utah. We have continued to release condors throughout the period, and there were 57 free-ranging individuals at the end of 2006.

California condors were first introduced in northern Arizona in December 1996, when six birds were released from BLM-administered lands at the western end of the Vermillion Cliffs. Eight additional releases followed through December 2000 (Arizona Condor Review Team 2002). Releases within the second five-year-reporting period began on February 16, 2002 when eight condors produced in 2001 were released at Vermillion Cliffs. An additional 38 condors were released there in 14 subsequent events (Table 1). Reintroductions generally involved road transportation of fledging-age captive-produced condors from the World Center for Birds of Prey Captive Breeding Facility to a 40x60x18-foot flight pen with adjacent 30x15x5-foot semi-enclosed box structure containing sheltered perches. All condors within the flight pen were exposed to a mock power pole fitted with a low voltage electrified cross arm for aversive conditioning to electrical structures.

Table 1. Summary of condor releases in the Southwest (2002-06).

Release Date	Location	Number Of New Condors Released	Died	Survive In Wild
February 16, 2002	Vermillion Cliffs	8	4	4
September 25, 2002	Vermillion Cliffs	3	1	2
March 3, 2003	Vermillion Cliffs	3	0	3
October 4, 2003	Vermillion Cliffs	2	0	2
November 29, 2003	Vermillion Cliffs	2	0	2
January 9, 2004	Vermillion Cliffs	1	0	1
March 20, 2004	Vermillion Cliffs	4	2	2
October 16, 2004	Vermillion Cliffs	3	1	2
February 4, 2005	Vermillion Cliffs	3	0	3
March 1, 2005	Vermillion Cliffs	5	1	4
May 25, 2005	Vermillion Cliffs	1	0	1
August 19, 2005	Vermillion Cliffs	2	0	2
October 12, 2006	Vermillion Cliffs	3	0	3
March 2, 2006	Vermillion Cliffs	3	0	3
September 12, 2006	Vermillion Cliffs	3	0	3
	Totals	**46**	**9**	**37**

Condors were observed, sometimes for months, in the flight pens and evaluated for potential release. Condors chosen for release were moved to a release pen (40x20x6 feet with an adjoining 40x8x5 feet semi-enclosed box structure for protection from the elements and predators) situated at the edge of the Paria Plateau in clear view of free-flying condors feeding, perching, and loafing around the release site. Both of the Vermillion Cliffs structures have been enhanced structurally and spatially since the last reporting period. Pre-release condors generally spent a week or two in the release pen to acclimate to their new surroundings and to nearby free-flying condors. TPF provided food in the form of stillborn dairy calves to condors in captivity and every three days after release. Among the newly-released condors were three two-year-olds from the California-based Pinnacles release site. Release of those individuals was part of an experiment to determine whether or not their previous behavior of perching on power-poles in California had become fixed. Thus far, none of the three birds have been observed on power poles since release in northern Arizona.

During the first five years of releases, we investigated the utility of a separate release site (Hurricane Cliffs south of St. George, Utah) to diminish the pressure of increased competition at feeding sites for newly-released condors, and to potentially reduce continual visitation of free-flying condors to Vermillion Cliffs. After several releases, however, the population had merged, so we reverted to single-site releases and increased the number of feeding stations at the Vermillion Cliffs site as a proactive measure to ensure socially low-ranking condors would get enough food. Later in the first five years, we also learned that the increased visitation of free-flying condors to the holding pens appeared to habituate the young held within to the older condors, thus making transition into a wild flock easier and faster. Once on the wing, the young seemed more ready to follow the wild population.

Continuing with changes made late during the first five years (Arizona Condor Review Team 2002), we reduced the number of birds per release and, on average, held birds longer which meant they were older at first release. After the normal behavioral evaluation to select individuals for release, we would release three or four individuals along with a few re-release candidates. Acknowledging that these first-time releases were still of the age that parents would continue to care for them in a natural setting, we nevertheless found that condors released under these two conditions (older and in the company of experienced birds) showed improved post-release behavior as compared with the early years of the program.

We have had the benefit of three different holding facilities, one in Boise, and two at the Vermillion Cliffs release site, so crowding has not yet been a problem. However, with expected increases in flock size, new release sites and/or additional feeding sites may be necessary. On the other hand, the more widely-ranging flock, and the dispersing of breeding pairs into territories as far as 70 miles from the release site, may be relieving the pressure of birds upon resources at the release site. Expanding the experimental area could increase the flexibility necessary for adaptive management (see Expansion of the Nonessential Experimental 10(j) Population Area section).

Monitoring and Data Collection

Prior to release, each condor was fitted with patagial (wing-mounted) number tags and a pair of patagially-mounted (rarely retrix-mounted) radio transmitters. The transmitters were either conventional Very High Frequency (VHF) or Global Positioning System (GPS/PTT) instruments (see below). Two (redundant) transmitters provided added security in case of failure of one of the units, and often supplied both GPS and conventional radio telemetry data. TPF recaptured the birds every six months, on average, to replace transmitters as needed. In addition, TPF took blood samples to monitor lead levels and West Nile Virus (WNV) post-vaccination antibody titers.

During the second five years of the reintroduction program, TPF increased the size of the field crew from six to eleven biologists for intensive monitoring of the increasing condor population through visual, radio, and GPS methods. TPF biologists and field workers tracked the daily movements and activities of condors throughout the reporting period. Because ground tracking has become more difficult with the increase in the number of free-flying birds and their more frequent and widespread movement throughout the region's rugged terrain, TPF has come to rely more on satellite-based GPS/PTT transmitters (Microwave Technology), a state-of-the-art alternative to ground tracking made possible by the AGFD. They weigh less than conventional transmitters and do not require modification of the normal attachment configuration. The GPS transmitters are designed to record hourly position fixes with resolution of approximately 50 meters, and to report them to orbital satellite arrays several times a day, providing TPF with nearly real-time information on a locations of individuals.

Each morning, TPF acquires the accumulated GPS fixes from the previous day using a telnet connection and transfers them to topographical maps in a GIS mapping system. The data are immediately transmitted to the field crew who use them to plan that day's tracking strategy and any necessary direct management actions. TPF has mapped entire sequences of movement by GPS-equipped condors, including, for example, pair formation, prospecting for nest caves, and incubation exchanges. The transmitters have been especially valuable in revealing locations of condor concentration and prolonged activity in difficult-to-access canyon regions, including remote areas of southwestern Utah and the western portion of the Kaibab Plateau. TPF uses the transmitters to locate foraging areas. Knowledge of foraging areas has become particularly important since the summer of 2000 when the first known lead-related fatalities occurred. In all, TPF has maintained over 80% contact with the population, documenting behavior, roost locations, foraging activities, and identification of group activities within the population. TPF uses these data to identify potential threats and opportunities to intervene as necessary in response to behavior and/or health needs, particularly lead poisoning which is the leading cause of death of condors released in northern Arizona.

To date, TPF has obtained more than 50,000 relocation fixes from an average of 17 GPS-equipped condors (Figure 2). The polygon in Figure 2 represents the core area of condor use. Condor use is focused on the North and South rims and river corridor of the Grand Canyon, the Kaibab Plateau, and the Kolob region area of southern Utah. The distance from the release site on the Paria Plateau to the South Rim of the Grand Canyon is approximately 50 miles. The distance from the release site to the Kolob area is approximately 70 miles.

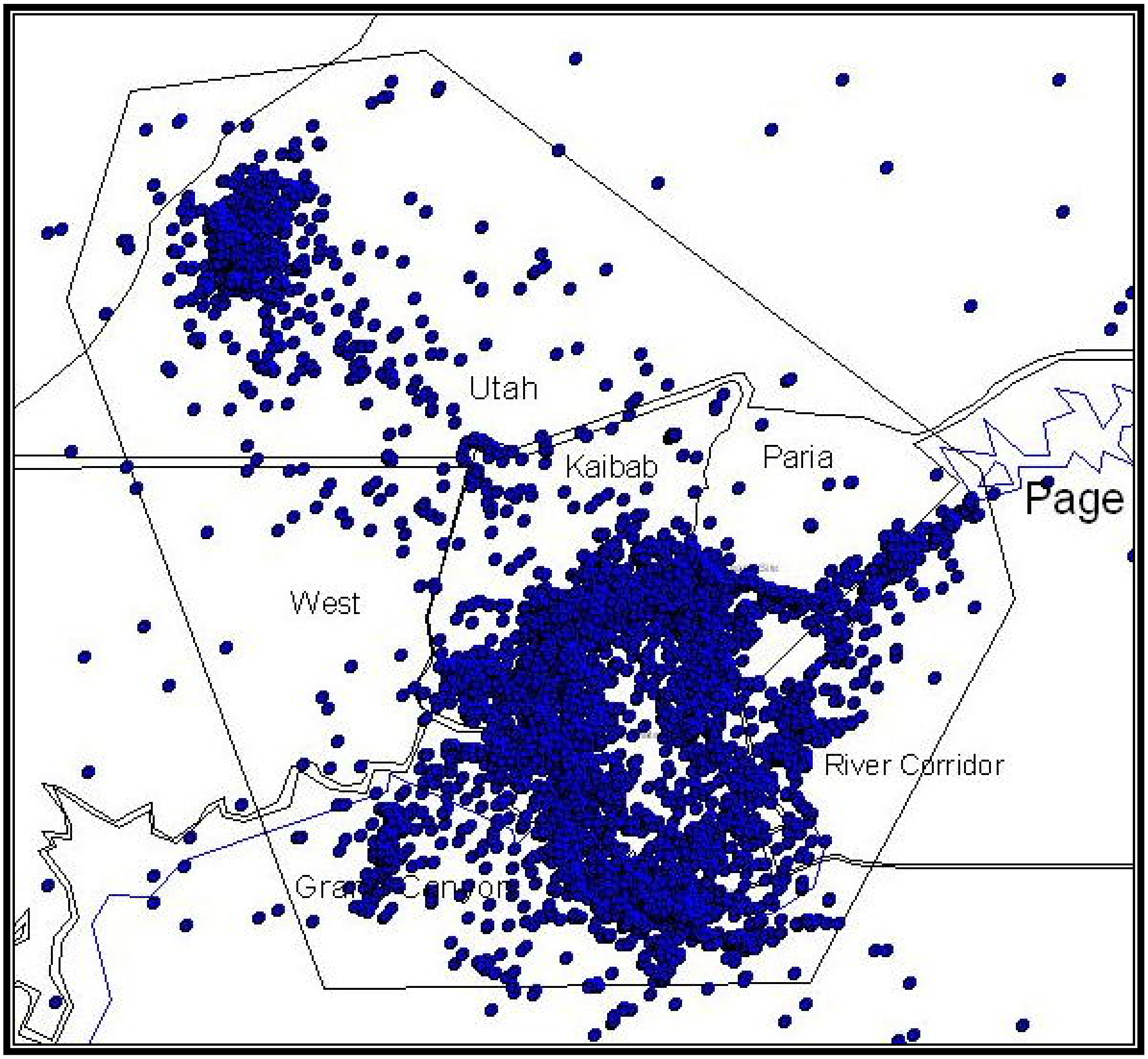

Figure 2. Condor locations obtained with GPS telemetry in 2002-06.

Behavior

TPF continues to condition condors by hazing and confinement for the purpose of breaking patterns of undesirable behavior as it relates to humans and artificial structures. TPF bases that effort on their experience over the course of the program that such conditioning results in improved behavior as the birds mature. During the 2006 season, for example, TPF placed four condors in detention for purposes of breaking behavior patterns, and retained two additional birds (that were later re-released) to prevent interference with a breeding pair which subsequently nested successfully. No bird has been deemed unreleasable under this protocol.

Courtship and Reproduction

2002

Courtship displays intensified in 2002, and as many as 14 condors were engaging in courtship activities between December 2001 and April 2002. The activity among those individuals resulted in formation of three pairs and a quad (two males and two females). Cave and cavity explorations were on the increase with one of the newest pairs, condors 134 and 149, focusing upon the Tapeats Canyon area on the northwest flank of the Kaibab Plateau. Two pairs, 119/122 (Battleship pair) and 123/127 (Dana Butte pair), selected caves at the South Rim of GRCA, laid eggs, and attempted incubation. For the second year in a row, condors 119/122 failed to produce a chick after a seemingly successful incubation period on the west wall of the formation known as the Battleship. When individuals from both pairs did not find food in the immediate area, they would make the 100-mile round trip to the release site to feed and then return. The normal interval between incubation exchanges was 4-7 days. No pairs were reproductively successful in 2002.

2003

The 2003 Battleship nesting attempt by pair 119/122 appeared to have failed in the last week of incubation. The precipitous abandonment of the nest by the adults seemed to indicate that something had gone wrong during the time TPF expected the egg to hatch. Further investigation of the nest by NPS climbers confirmed that only eggshell fragments remained in the cave.

The Dana Butte pair, condors 123/127, moved to a new location in the Salt Creek drainage, approximately one mile west of their previous 2002 attempt. Unable to see into the Salt Creek nest cave, TPF was initially reluctant to conclude the condors had produced a chick, but the chick was finally confirmed on August 16, 2003. Regular feedings were observed and documented, and chick 305 fledged on November 5 at 1339 hours, the first wild-produced fledgling in the history of the condor release program in the Southwest.

A quad formed in 2003 that included several of the condors involved the previous year. One of the females produced an egg in a cave on the southwest corner of the Paria Plateau. TPF attempted, unsuccessfully, to gain view of the cave that the quad (consisting of condors 114, 126, 133, and 162) had chosen as a first nest site. Several attempts by three climbers from cooperating agencies finally revealed egg shell fragments but little more. The quad continued to search out other potential nest caves after their failed nest attempt. Hoping that they would try again, TPF decided to encourage the quad to break into two pairs by recapturing condors 126 and 162. TPF was successful in recapturing them, but soon had to release them when a mountain lion fixated on the pen.

2004

Courtship displays intensified again in 2004, and by the end of February as many as 16 condors were engaged in courtship activities. Nest cave explorations increased, and one of the newest pairs, condors 133 and 158, intensively explored the west flank of the Kaibab Plateau for the first time but did not choose a nest. Two other pairs were successful in producing viable eggs. After trapping two problematic birds involved in a quad in 2003, condors 114 and 149 (a new pairing) were able to choose a nest cave only 600-700 meters from the Vermillion Cliffs release area. Based on observations, TPF suspected that the female laid an egg in the middle of March. The chick of that pair, later labeled Condor 342, fledged on November 23, 2004, and is doing well in the wild.

Condors 119 and 122, in their third year's attempt, followed suit with the laying of an egg in what has been referred to as the Battleship nest cave within the GRCA. The chick was visually confirmed in July just three days after the Vermillion Cliffs chick was observed. Condor 350 fledged two days after the Vermillion Cliffs chick on November 25, 2004. Condor 350 is still alive and well in the wild.

2005

There were two successful nesting attempts in 2005; one on the Vermillion Cliffs and one in the Grand Canyon. A third new pair nested on the Kaibab Plateau. Condor 114 and a new female Condor 126 nested in the same nest cave on Vermillion Cliffs that was used by 114 and 149 in 2004. The newest Vermillion Cliffs chick, Condor 389, was first observed on June 24, 2005, and successfully fledged on November 30, 2005. Condors 123 and 127 returned to production after a successful fledgling in 2003 with a new attempt yielding yet another chick from the Salt Creek cave. Condor chick 392 fledged on December 23, 2005. This young condor spent considerably more time on the ground than other wild-fledged juveniles, but later in the 2006 season took to flying with the rest of the flock.

A new pair initiated their first attempt on the east flank of the Kaibab Plateau where they utilized an ancient granary. All appeared well for condors 136 and 187 until late July when TPF concluded that hatching was overdue by nearly 30 days. On June 3, 2005, both condors returned to the release site and roosted there that evening which was a sure sign that they had failed. Within several days, TPF recovered the egg and submitted it for necropsy, which determined that the egg had died in the late stages of incubation.

2006

There are currently eight condor pairs in the wild in Arizona. Four pairs have fledged five young, beginning in 2003, and four of those five young survive today. Three pairs nested in 2006, but none were successful. After the Battleship Pair (119 female, 122 male) fledged Condor 350 within the Grand Canyon in 2004, the pair moved to a new location less than a mile from the original nest and appeared to have laid an egg. One pair member (male Condor 122), however, exhibited the symptoms of late-stage lead poisoning just two weeks into incubation, and TPF was forced to capture it for treatment. Its mate (female Condor 119) subsequently abandoned the nest despite efforts to provide food in the area of the nest cave. A second pair (133 female, 158 male) established a nest and laid an egg in its first attempt on the west flank of the Kaibab Plateau. Although the incubation schedule appeared to be normal, the pair ultimately abandoned its unhatched egg well past term. TPF collected the egg and submitted it for analysis which revealed that the egg was fertile, but like another first attempt, the egg had died just before hatching. The third pair (136 female, 187 male) nested on the east flank of the Kaibab Plateau as they had in 2005. As in the 2005 attempt, their 2006 egg also failed to hatch, even though the eggs of both years were determined to be fertile. These events are not surprising, given that some of the other successful pairs have failed in their first two attempts.

Movements

The extent and pattern of condor ranging has changed somewhat from that of the first reporting period. In particular, the number of condors involved in courtship, pair formation, and breeding has increased with the number of mature, experienced birds. Condors have extended the length of time they frequent areas away from the release site, and they appear far more proficient in finding carrion. Toward the end of this reporting period, it appeared as though the observed dispersal of older breeding-age birds might result in more permanent changes in observed yearly movements. For example, a number of birds have come to reside for long periods in the hills outside Zion National Park (Figure 3), although during winter they have tended to return to the area of the release site where food is always available. The birds have frequented the area of two reservoirs (Kolob and Blue Springs) as well as several high-mountain meadows southeast of Cedar City (Figure 4).

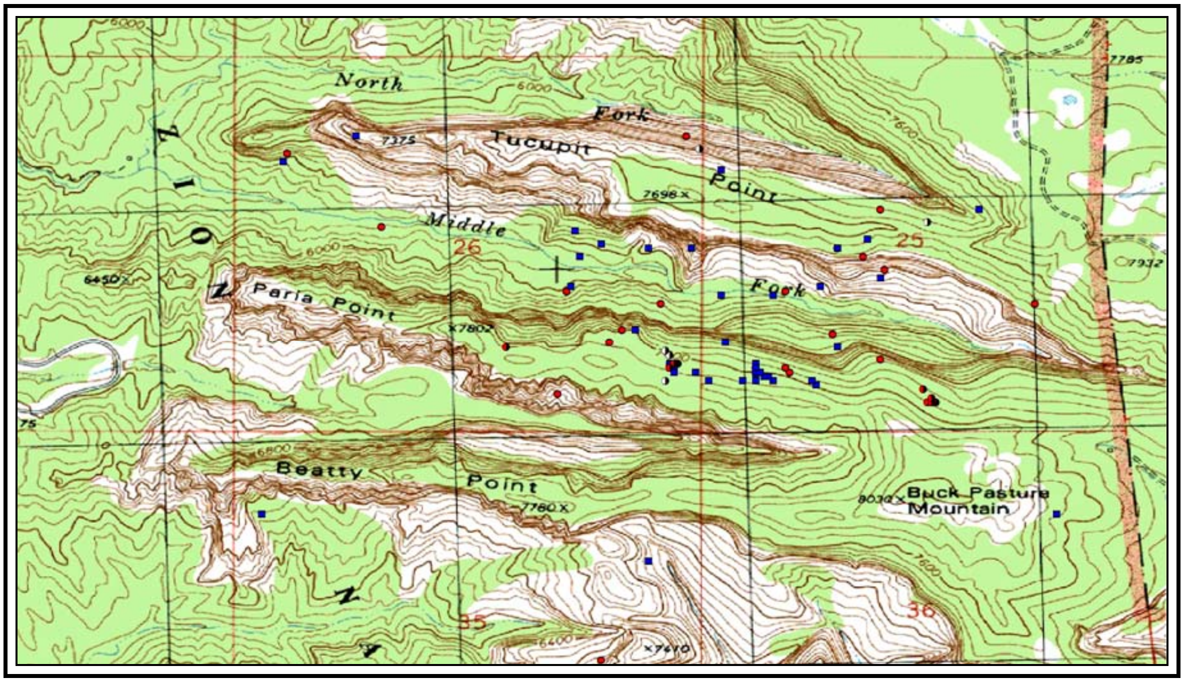

Figure 3. Condor locations during September 2006 in Kolob Canyon of Zion National Park (symbols of differing shapes and colors represent individual condors).

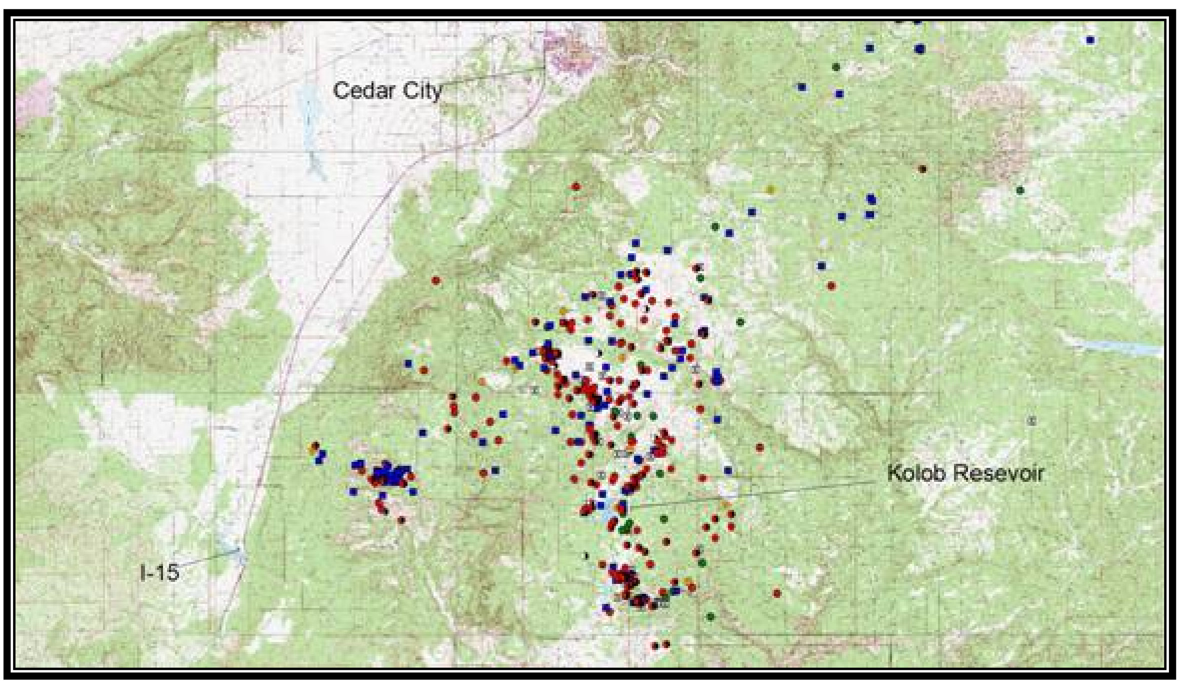

Figure 4. Condor use of the Kolob region of southern Utah obtained with GPS telemetry (symbols of differing shapes and colors represent individual condors).

Frequent condor movements to the Kaibab Plateau over the past five years have been the cause of both optimism and concern (Figure 5). The good news is that condors are ever more proficient in finding food on their own which strengthens the prognosis of an eventual self-sustaining and entirely wild population. However, there is increasing evidence that condors are encountering lead bullet fragments and pellets in the remains of rifle-killed deer (*Odocoileus* spp.), shot coyotes (*Canis latrans*), and hares (e.g., *Lepus* spp.) (Hunt *et al.* 2006). The GPS transmitters have been valuable for determining the exact locations of condor activity both in real time and in retrospect when individual condors later recaptured and tested at the release site show high lead levels. The transmitters have allowed TPF to locate and examine scavenged carcasses in a number of instances.

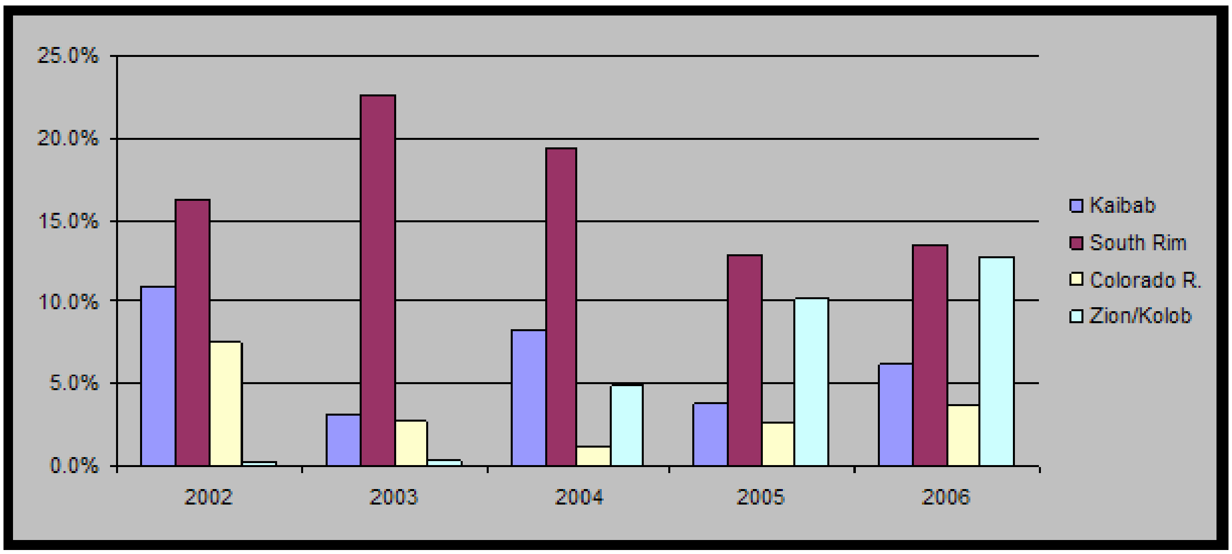

Figure 5. Condor night roost locations in areas outside the release site obtained with VHF telemetry (note the dramatic increase in the use of the Zion region of southern Utah in 2004 through 2006).

Health

For the purposes of analyzing and responding to lead exposure, the levels listed in Table 2 are used. For more information on lead exposure, the decision tree for treatment, and the treatment process (e.g. chelation) see Parish *et al.* (in press; abstract 3 in Appendix B).

Table 2. Lead exposure and response categories.

Field Blood Lead Level (µg/dl)	Indication	Management Response
0-14	Background	None
15-29	Exposure	Monitor
30-59	Exposure	Hold and monitor
>60	Toxicity	Hold and treat

During the first five years of the condor release program in Arizona, lead poisoning appeared to constitute an episodic rather than a chronic threat to condor survival. Throughout most of the first reporting period, there was little indication of lead exposure. In the early summer of 2000, however, a series of lead exposures and deaths (and additional suspected deaths) from ingesting lead shotgun pellets occurred. Two years later, in the fall of 2002, increased condor use of the Kaibab Plateau corresponded to elevated levels of lead in blood samples, followed by a similar pattern in subsequent years. The high yearly incidence of lead exposure during this reporting period has necessitated continued blood sampling and treatment (Figure 6). Meanwhile, research has identified condor use of rifle-killed deer and coyotes as the principal pathway of lead to condors in Arizona (Fry *et al.* 2003, Church 2006, Hunt *et al.* 2006, Hunt *et al.* in press). TPF radiographs have illustrated lead pellets and fragments in the digestive tracks of lead-poisoned condors and bullet fragments in rifle-killed deer and coyotes known to have been fed upon by condors. Moreover, TPF radiographs of the remains of deer killed with standard lead-based rifle bullets revealed a profusion of metal fragments as the normal condition. With the aid of GPS-satellite telemetry, TPF found an abrupt increase of blood lead levels corresponding with increased condor use of deer-hunting areas on the Kaibab Plateau in 2002 and thereafter. For additional information regarding lead exposure in relation to movements see Hunt *et al.* (in press; abstract 2 in Appendix B). Spikes in blood lead levels were associated with condor visitation to the Kaibab Plateau during and just after the 2002-2006 deer seasons, and there were significantly higher lead levels among condors visiting the plateau in the weeks prior to testing. The AGFD has responded by offering non-lead bullets to deer hunters in the primary area of exposure and a majority of the hunters have enthusiastically endorsed the program.

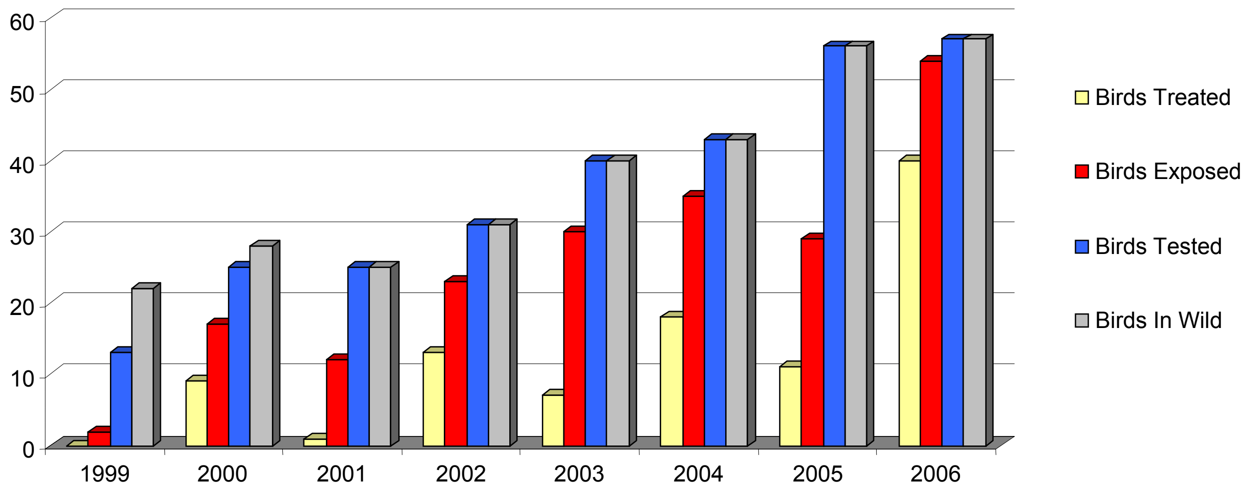

Figure 6. Number of condors exposed to, tested, and treated for lead (1999-2006).

The possibility of WNV in the wild population has been a concern as well. Since 2003, TNF has vaccinated condors and obtained blood samples to determine titers for WNV. So far, there has been no evidence of WNV in this population.

Below is a year-by-year summary of events associated with condor health in Arizona as reported by TPF:

2002

We were able to trap and test all birds in the population when they came to the release site, and we treated those birds that revealed high levels of lead in blood. In all, we found 23 condors with elevated levels, with 13 requiring treatment to purge the lead from their systems.

2003

We trapped all of the birds every six months to replace transmitters and take blood samples. We administered WNV vaccinations in July and August to all 40 condors in the Arizona population as per protocol from the Centers for Disease Control. Incidental to this abnormally-timed capture, we found evidence of 13 cases of lead exposure requiring five chelations. Two of the individuals (condors 203 and 235) requiring treatment had been observed feeding on a coyote carcass that we suspected to have been shot. We tested the coyote carcass and found metal fragments within the heavily scavenged carcass. Within two days the two condors associated with the contaminated carcass were trapped, tested, and radiographed. Both condors had radio-dense objects within their digestive tract and high blood lead levels, and both were immediately transferred to the Phoenix Zoo for treatment. Condor 235 had a blood lead level of 554µg/dl.

Both condors survived the lead exposure, subsequent treatment, and removal of the lead fragments. They were later released near the Vermillion Cliffs.

2004

Beginning June 17, 2004, we trapped every wild condor with the exception of the two new chicks and missing Condor 176. We vaccinated each bird (44 wild and 6 captive) for WNV per the protocol from the Centers for Disease Control and obtained blood samples for evaluating WNV titers. Incidental to the captures, we found evidence of 24 cases of lead exposure (>15µg/dl); two of those cases required chelation. The two individuals (condors 210 and 235) requiring treatment were observed feeding on carcasses that we suspected had been shot. But we found no fragments or pellets in what remained of the carcasses, nor did we find fragments in x-rays of these condors despite the high levels of lead in their system. After treatment, both condors were later released near the Vermillion Cliffs. Other trapping events revealed another 11 condors with indications of lead exposure and 16 more were chelated primarily in the winter months.

2005

We collected 171 blood samples during the reporting period; all free-ranging condors were tested as in past years. Over 50% showed lead levels indicative of lead exposure (>15 µg/dl), and 23% (18 birds) required chelation treatment. Radiographs of four condors showed visible lead fragments (n =2) or shotgun pellets (n =2) in their stomachs. The condors with the pellets died, whereas the lead fragments of the other two were removed by a purging procedure administered by Dr. Kathy Orr, DVM, at the Phoenix Zoo.

To further advance the understanding of the lead issue, we supplied blood samples to the University of Arizona for a study sponsored by the AGFD to investigate lead isotopes in blood and lead fragments recovered in wild carrion and the digestive tracts of condors. We published a paper on the extent and pattern of rifle bullet fragmentation in deer (Hunt *et al.* 2006). We also presented three papers at the August 2005 meeting of the American Ornithologists Union (AOU) at the University of California at Santa Barbara and have submitted all three for publication in a special AOU symposium volume on the California condor. Although some of the papers will not appear until 2007, all are available through the internet at www.perergrinefund.org and www.azgfd.gov/condor. Also see abstracts 1 through 4 in Appendix B.

2006

TPF continued to focus on lead exposure detection and treatment as an essential element in maintaining the population. We collected 167 independent blood samples during the reporting period. As in past years, all free-ranging condors (n=57) were tested at least once during the reporting period. Fifty-four (95%) of the individuals showed lead levels indicative of lead exposure (>15 µg/dl) occurring at some point in the reporting period. Thirty-four of the latter

(60%) revealed lead levels exceeding 65 µg/dl, and 40 birds (70%) were chelated. Radiographs of four of these condors showed radio-dense fragments consistent with those recovered in past years. The fragments were removed by a purging procedure administered by Dr. Kathy Orr and other staff at the Phoenix Zoo. As in the past, the Phoenix Zoo played an important role in the treatment of six lead-poisoned condors during 2006; four of the condors had late-stage lead poisoning. The condors were ataxic with crop stasis and some with lower extremity paralysis. Surgical procedures, including pharyngostomy and ingluviotomy, were utilized in treating the four condors, two of which were too sick to benefit from the procedure and later died. Two additional condors were treated at the Phoenix Zoo in January 2007 and died soon thereafter from exposure in 2006 and are therefore included in this document. An additional condor died of lead poisoning sometime in December 2006, and was collected from the field in January 2007.

In summary, shotgun pellets and rifle bullet fragments in animal carcasses have been the primary source of lead contamination to condors in Arizona. Radiographs allowed observations of lead pellets and fragments in the digestive tracks of lead-poisoned condors and bullet fragments in rifle-killed deer and coyotes known to have been fed upon by condors. Moreover, radiographs of the remains of deer killed with standard lead-based rifle bullets revealed a profusion of metal fragments as the normal condition (Hunt *et al*. in press). With the aid of GPS-satellite telemetry, TPF found that an abrupt increase of blood lead levels corresponded with increased use of deer-hunting areas on the Kaibab Plateau in 2002 and thereafter. Spikes in blood lead levels were associated with condor visitation there during and just after the 2002-06 deer seasons, and there were significantly higher lead levels among condors visiting the Kaibab Plateau in the weeks prior to testing.

Mortality

We recorded 18 fatalities in the first five-year period and 20 in the second five-year reporting period (Tables 3 and 4). Two of the lead-caused fatalities occurred in January 2007 but were the result of exposure in 2006 and are therefore reported here. One additional lead fatality with an undetermined date of death was recovered from the field in January 2007. GPS telemetry data indicate last activity in 2006, and therefore this fatality is also reported in this reporting period. Predation of newly-released condors, together accounting for one-third of fatalities during the first period, has been since mitigated by adaptive management, i.e., hazing of recently released condors to safer roosts, holding young condors longer before release, and the benefit of integrating into a larger, more experienced flock. We have recorded no collisions or electrocutions since installing mock power poles, although there are comparatively few powerlines in the region. The "suspected lead poisoning" category in the first period stemmed from the coincidental deaths of undiagnosed condors with an episode of known poisoning fatalities. The higher number of deaths from lead ingestion in the second period principally resulted from an increased reliance on wild carrion (Hunt *et al.* in press). We cannot rule out the possibility that a proportion of fatalities in the "missing" and "unknown" categories were lead related. Moreover, we believe that significantly more deaths would have occurred had we not performed some 89 chelations during the second period.

The single fatality of a wild-hatched individual (Condor 305) occurred at 501 days post-fledging during the transition to independence from parental feeding. Due to the condition of the body at the time of recovery, an exact cause of death was not determined. The other four wild-hatched chicks are integrated into the flock and are surviving today.

Table 3. Condor mortality factors of the first and second five-year periods of the reintroduction program (includes birds that died or were recovered from the field in 2007 as a result of lead exposure in 2006).*

Mortality Factor	**1996-2001**	**2002-2006**
Coyote predation	4	1
Eagle predation	3	0
Lead poisoning	3	9*
Suspected lead poisoning	2	0
Power line Collision	1	0
Shooting	1	2
Starvation	1	2
Septicemia (blood poisoning)	1	0
Missing	2	4
Unknown	0	2

*Table 4. Condor fatalities of the second five-year period of the reintroduction program (*indicates a bird that died or was recovered from the field in 2007 as a result of lead exposure in 2006)*

Condor	Source of Mortality	Sex	Age at Release (years)	Age at Death (years)	Days Free-flying
252	Coyote	Male	0.8	0.8	0
347	Starved	Male	0.8	0.9	34
240	Lead	Male	0.8	1.4	202
258	Shot	Male	0.7	1.4	251
305	Starvation	Male	Wild hatched	1.9	501
353	Missing	Female	1.7	2.0	100
300	Missing	Female	0.9	2.1	426
291	Unknown	Male	1.6	2.5	360
304	Lead	Male	0.9	2.9	727
249	Lead	Male	1.4	4.1	1001
186	Shot	Male	0.6	4.4	1382
198	Unknown	Male	1.0	4.5	1256
235	Lead	Female	0.6	5.1	1640
248*	Lead	Female	0.8	5.6	1763
176	Missing	Female	0.7	5.9	1911
227*	Lead	Male	0.7	6.7	2205
232*	Lead	Male	0.7	6.7	2191
196	Missing	Male	0.7	7.3	2414
149	Lead	Female	0.5	9.8	3385
119	Lead	Female	2.2	11.8	3517

Demography Overview

We addressed the overall impact of the various mortality agents on the demography of the condor population in Arizona and Utah in a paper presented by Woods *et al.* (in press; see abstract 4 in Appendix B) at the AOU conference in August 2005. The authors concluded that, in the absence of releases, the condor population can be expected to increase under a projected rate of natural reproduction, but that increase would require the continuation of the current regime of lead testing and treatment. This suggests that, whereas the population can apparently tolerate the impact of the aggregate of other mortality factors, the added impact of lead-related deaths resulting from lack of treatment would likely prevent the establishment of a self-sustaining population. The difficulty of making such assessments with condors is that adult survival must necessarily be very high because very small proportional changes in mortality can have large effects on demographic trend. Given the relatively small size of the population, a small increase in the number of annual deaths can negatively impact the trend of the population. Lead poisonings can be episodic, like those observed in summer 2000, so the question of sustainability will remain unanswered for some time to come. Meanwhile, we will continue to closely monitor the population and to apply adaptive management whenever and wherever indicated.

Analysis of demographic data is an involved process, often including evaluation of the number of days each bird was free-flying in relation to its death, as described for example in Woods *et al.* (in press). A full evaluation using this process is underway for the past five years of the project. Below is a very simple listing of birds in the population and their survival which is provided to partly address the "mortality rate" requirement of the rule designating the experimental population.

For the first five-year review period (1996-2001):

- 47 individuals were released; 18 (38.3%) individuals died
- 3 individuals were returned to captivity

For the second five-year review period (2002-2006):

- 26 individuals survived from the first period; 9 (34.6%) individuals died
- 46 individuals were released into the population; 10 (21.7%) individuals died
- 5 wild-hatched chicks were added to population; 1 (20%) individual died
- Overall, there were 77 individuals in the population; a total of 20 (26%) died

For the first ten years of the reintroduction program (1996-2006):

- 93 individuals were released
- 3 individuals were returned to captivity
- 5 wild-hatched chicks were produced
- 38 (40%) of the 95 individuals (that were not returned to captivity) died

LEAD-REDUCTION EFFORTS

Introduction

Although lead toxicity in wild condors in California had previously been identified as a concern among wild condors in California (Janssen *et al.* 1986, Wiemeyer *et al.* 1988, Snyder and Snyder 1989 and 2000, Pattee *et al.* 1990, and Meretsky *et al.* 2000), it was unknown if lead toxicity would be a significant problem among the reintroduced condor population in northern Arizona and southern Utah. Lead toxicity was identified as a management issue during the first five years (1996-2001) of the Arizona reintroduction program (Arizona Condor Review Team 2002), but it has only been during the last five years (2002-06) that condor lead exposure has emerged as a critical management issue. Lead toxicity has been identified as the leading cause of condor mortality, with twelve confirmed and two suspected cases (see Mortality section; Woods *et al.* in press, see Appendix B). Since the first known lead exposure incident in 2000, condor dispersal from the release site has intensified, resulting in increased foraging on non-proffered carrion such as mule deer (*Odocoileus hemionus*), elk (*Cervus elaphus*), and coyotes (Cade *et al.* 2004; Parish *et al.* in press, see Appendix B). During this time, the highest frequency of lead exposure in condors has been associated with increased movements away from the release site, and the consumption of non-proffered carcasses potentially containing lead from spent ammunition (Hunt *et al.* 2006, see Appendix B; Hunt *et al.* in press, see Appendix B). Moreover, since 2002, the highest numbers of lead exposure events have repeatedly occurred during the fall hunting season in the Kaibab Plateau region (Hunt *et al.* in press). Furthermore, ingested lead pellets and bullet fragments have been recovered from the digestive tracts of several condors that tested positive for lead exposure (Parish *et al.* in press).

Since 2002, condor trapping, lead testing, and treatment efforts have been amplified in response to the increased threat of lead exposure (Cade *et al.* 2004, Parish *et al.* in press). Although field biologists have managed to reduce the number of condor deaths due to lead toxicity by pursuing this rigorous monitoring and treatment protocol (Parish *et al.* in press), these efforts are highly invasive, labor intensive, and costly. In addition, the long-term sub-lethal effects of lead exposure in condors are unknown. Thus, it is unlikely that the northern Arizona and southern Utah condor program will succeed at achieving a self-sustaining condor population with the above-mentioned lead exposure situation (see Demography Overview section).

After the fall 2002 hunting season (see Health section), it became evident to project cooperators that steps must be taken to reduce the amount of lead available to condors in Arizona. A voluntary lead-reduction program was initiated in 2003. While research into the prevalence and effects of lead on condors (Fry and Maurer 2003, Fry 2004, Church *et al.* 2006) and lead-reduction efforts (see www.projectgutpile.org) have also occurred in California, efforts in Arizona have focused on voluntary measures to reduce the amount of lead available to condors in the wild. This is due to a consensus among project cooperators that voluntary measures are the best course of action to take in Arizona. Further, unlike releases in California, condors in Arizona are managed under the 10(j) rule of the ESA (see the Compliance of Federal Agencies with Sections 7(a)(1), 7(a)(2), and 7(a)(4) of the Endangered Species Act section and U.S. Fish and Wildlife Service 1996a).

For a timeline of significant lead-reduction efforts undertaken by condor project cooperators, see Appendix C. Information on lead-reduction efforts in Arizona through 2005 was also reported in Sullivan *et al.* (in press; see abstract 5 in Appendix B). Surveys and research cited in this section are available on-line at www.azgfd.gov/condor and www.peregrinefund.org.

Surveys and Focus Group

In May 2003, the lead reduction subcommittee of the California Condor Recovery Team compiled a report on condor-lead issues (Redig *et al.* 2003). As part of the effort to reduce lead exposure in condors, the AGFD contracted the Wildlife Management Institute (WMI) to determine hunter knowledge of and attitudes towards lead poisoning in condors. Responsive Management and D. J. Case and Associates (D. J. Case) were contracted by WMI to determine the knowledge and attitudes.

During the fall of 2003, Responsive Management conducted phone surveys of 205 Arizona and 200 Utah hunters (Responsive Management 2003 and 2003a). Among other questions, hunters were asked if they were aware that lead poisoning was a problem faced by condors; if they were aware of any educational efforts to try to reduce lead poisoning in condors; and what actions they would be willing to take to help reduce lead exposure in condors. Key findings from the surveys included that only 23% of Arizona hunters and 12% of Utah hunters were aware that lead poisoning was a problem faced by California condors. In addition, only 9% of hunters in Arizona and 2% in Utah were aware of any educational efforts to reduce condor deaths from lead poisoning. However, most Arizona and Utah hunters stated they would be "somewhat or very willing" to take actions during their hunt to help condors. These actions included: removing all carcasses from the field (97% AZ, 98% UT); burying or hiding all gut piles (89% AZ, 86% UT); removing bullets and surrounding affected flesh (84% AZ, 78% UT); and using non-lead ammunition (83% AZ, 78% UT). These data established a baseline to measure subsequent changes in hunter knowledge and opinions.

D. J. Case incorporated the data from these phone surveys with information from interviews of condor professionals and literature searches to develop condor conservation and lead-reduction test messages. Test messages were discussed and rated during three focus group meetings of Arizona and Utah hunters and ranchers held in December 2003 (D. J. Case and Associates 2005). The best-scoring communication message from the focus groups was: "Hunters and ranchers have a long history of caring for the land and conserving all kinds of wildlife. They can continue this tradition and help prevent lead poisoning in California condors by taking one or more of the following actions in condor range: use non-lead ammunition; retrieve all animal carcasses; hide carcasses or gut piles to make them inaccessible to condors; and/or remove bullets and affected flesh from animal carcasses left in the field." Focus groups also revealed that hunters and ranchers were not convinced that spent lead ammunition was a major cause of condor lead poisoning. They requested credible data linking lead ammunition to condor lead poisoning. They also expressed a greater willingness to help condors if asked by a credible source. In Arizona, hunters and ranchers considered sportsmen's groups and the state wildlife agency to be the most credible sources.

Focus group results were then utilized to develop a communication strategy. The strategy included actions such as increased education, communication and cooperation between condor project cooperators and the hunting community, continued condor lead exposure research, and the implementation of a non-lead ammunition program (D. J. Case and Associates 2005 and 2005a).

Education and Communication

Data obtained from the phone surveys and focus groups were utilized to create an education and communication strategy to gain support for voluntary lead reduction efforts in Arizona's condor range (D. J. Case and Associates 2005). In 2003, the AGFD began hunter education and communication efforts and have expanded these efforts each subsequent year. Each year from 2003-06, condor lead exposure data, accompanied by a request for voluntary lead reduction actions, were mailed to 3,700-7,800 hunters drawn for hunts within the condor range in northern Arizona. In addition, a full page in the Arizona hunting regulations has been devoted to the condor-conservation and lead-reduction message since 2003. Notices about condors and lead have also been posted in the Kaibab Plateau region for deer and varmint hunters. Condor-lead educational booths at shooting events and sportsman's expos have also been utilized.

The AGFD encouraged local sportsmen's groups to join a Condor Coalition consisting of sportsmen's groups and government agencies supporting voluntary efforts to reduce the amount of lead available to condors. As of January 2007, local and national Condor Coalition members included the Arizona Antelope Foundation, Arizona Deer Association, Arizona Desert Bighorn Sheep Society, Arizona Elk Society, AGFD, Arizona Chapter of the National Wild Turkey Federation, Boone & Crockett Club, BLM-ASDO, GRCA, International Hunter Education Association, Kaibab National Forest, National Shooting Sports Foundation, North American Grouse Partnership, Sporting Arms and Ammunition Manufacturers' Institute, TPF, FWS, and WMI. Coalition members support voluntary lead-reduction efforts within the condor range and fund condor conservation and lead-reduction educational efforts.

Personnel from cooperating agencies of the Arizona condor project, including AGFD, TPF, NPS, FWS, USFS, and BLM attended "one-voice" condor training on August 5, 2005. Project cooperators were trained to communicate a consistent and effective message regarding voluntary lead-reduction efforts in the condor range. Personnel also continued to disseminate the condor lead-exposure-reduction message within their agencies and to the public. Representatives from Arizona sportsmen's groups also attended "one-voice" condor training on August 6, 2005, in order to disseminate accurate and consistent information to their members.

The general public has received the condor-conservation and lead-reduction message through educational presentations, wildlife-fair displays, the internet, and media outlets. AGFD and TPF have presented forty to seventy condor educational programs each year between 2003 and 2006. AGFD's condor web page (www.azgfd.gov/condor) first carried the condor lead-reduction message in 2003, and has been expanded and updated each year to incorporate ongoing research and new information on condors and lead. Media coverage has included magazine and newspaper articles in local publications, as well as a condor segment on AGFD's "Wildlife

Views" television program and a piece in AGFD's "Wildlife Views" magazine. Since 2003, AGFD's lead-reduction outreach efforts have reached an estimated 10,000 people annually.

Lead Research

Arizona and Utah hunters and ranchers indicated that they needed more data linking lead ammunition to condor lead poisonings to increase their support for voluntary lead reduction efforts (D. J. Case and Associates 2005). The AGFD and TPF responded by conducting and funding five research projects related to condor lead exposure and lead ammunition. First, TPF condor project biologists recorded lead exposure and lead ammunition ingestion by condors starting in 1999 and have summarized the data through June 2005 (Parish *et al.* in press; see abstract 3 in Appendix B).

Second, lead toxicity mortality rates were recorded by TPF and summarized through January 2005 (Woods *et al.* in press; see abstract 4 in Appendix B). Data from these two studies verify that lead exposure is a critical management issue in Arizona. Starting in 2004, condor lead exposure, lead-ingestion, and lead-toxicity data have been reported to hunters in the annual AGFD hunting regulations and reported to the public through educational programs.

Third, since 2003, AGFD has purchased 21 GPS satellite transmitters to track condor movements. Transmitters were mounted on the patagia of individual condors and TPF used data from these transmitters along with data from conventional VHF transmitters to compare condor movements between July 2001 and June 2005 in relation to lead-exposure rates (Hunt *et al.* in press, see abstract 2 Appendix B). An association between high lead-exposure rates and increased use of the Kaibab Plateau in northern Arizona during deer hunting season was confirmed (Hunt *et al.* in press). Starting in 2005, data from this study have been shared with hunters and the public.

Fourth, TPF conducted research from 2002 to 2004 to determine the extent of lead bullet fragmentation in rifle-killed deer (Hunt *et al.* 2006, see abstract 1 in Appendix B). This study demonstrated that standard lead bullets typically fragment into hundreds of pieces before exiting a target such as a deer, and that these fragments remain in the deer carcasses as well as the gut piles. The study also confirmed that the fragmentation rate of pure copper bullets is minimal compared to that of lead bullets (Hunt *et al.* 2006).

The fifth study is an ongoing lead isotope study funded by the AGFD and conducted by the University of Arizona, Tucson, using biological samples provided by TPF condor biologists. This study aims to conclusively determine the pathway for lead exposure in condors. Lead isotope ratios of condor blood and lead removed from condor digestive tracts are being compared to lead isotope ratios of lead retrieved from carcasses on which condors feed, lead ammunition, and other possible lead sources. Preliminary results have established a direct match between lead ammunition and lead found in condor blood and digestive tracts (Chesley *et al.* 2006). As they become available, data from this study are incorporated into the communication strategy and shared with the public.

Non-lead Ammunition Program

The AGFD, using money from the Heritage and Wildlife Conservation funds (i.e., Arizona state lottery and Indian gaming revenue), administered a free non-lead ammunition program for the fall 2005 and 2006 hunting seasons in game management units within the condor range in Arizona. AGFD partnered with Cabela's, Sportsman's Warehouse, Federal Ammunition, and Barnes Bullets and offered free non-lead ammunition to deer, pronghorn (*Antilocapra americana*), bighorn sheep (*Ovis canadensis*), and buffalo (*Bison bison*) hunters drawn for hunts within the core condor foraging range (game management units 12AE, 12AW, 12B, and 13A, see Figure 7). Coupons to obtain the free ammunition accompanied a letter outlining condor lead poisoning issues and asking for hunters' help in reducing the amount of lead available to condors. Coupons were mailed at the beginning of August. The fall hunting season began in late October and continued through December. Coupons were redeemable through mid-November each year.

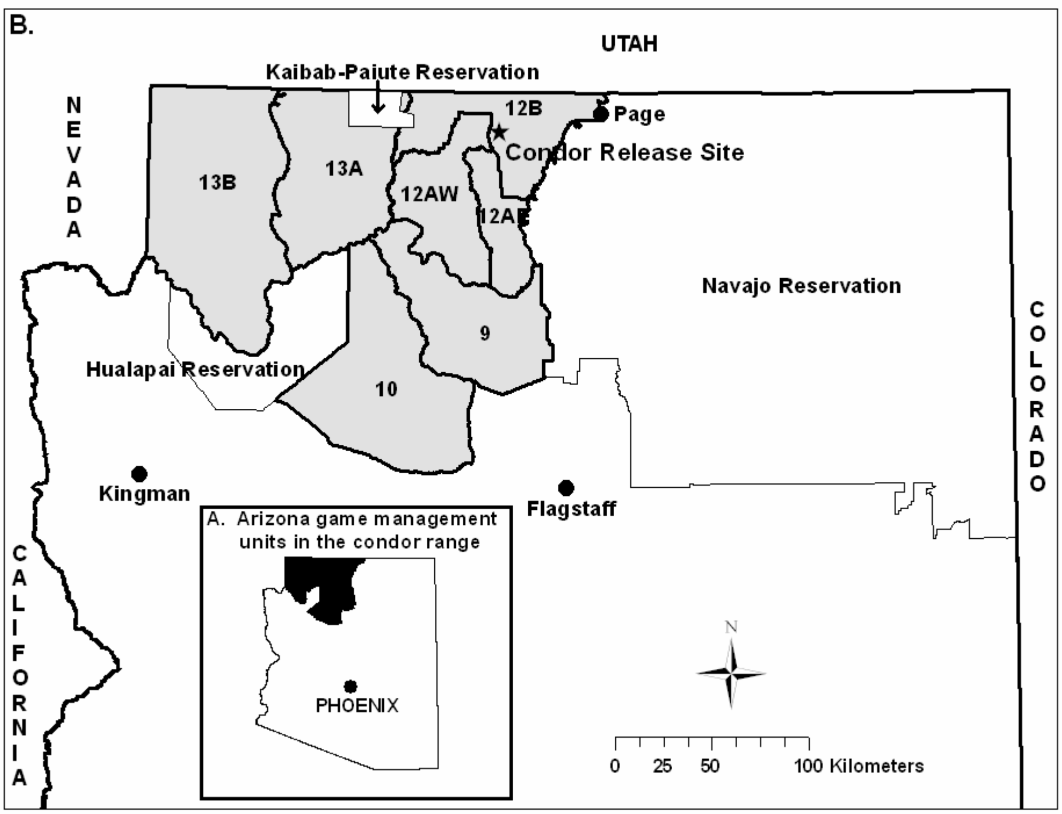

Figure 7. Arizona game management units within the condor range.

In 2005, hunters holding permits for deer, bighorn sheep, and buffalo rifle hunts in Units 12AE, 12AW, and 12B qualified for the free non-lead ammunition program, and hunters holding permits to hunt big game in Units 9, 10, 13A, and 13B were mailed letters asking them to take voluntarily lead-reduction actions. In 2006, hunters holding permits for deer, pronghorn, bighorn sheep, and buffalo rifle and muzzleloader deer hunts in Units 12AE, 12AW, 12B, and 13A qualified for the free non-lead ammunition program. Hunters holding permits to hunt big game in Units 9, 10, and 13B were also asked to take voluntary lead-reduction actions. Turkey (*Meleagris gallopavo*) hunters from all Units were mailed letters asking them to take voluntary lead-reduction actions for the spring and fall hunts each year. Hunters who participated in the free non-lead ammunition program received either 40 rounds of loaded rifle ammunition, 50 bullets for hand-loading, or 48 muzzleloader rounds and were encouraged to properly sight in their gun before their hunt.

In 2005, 1,551 (65%) of the 2,390 eligible hunters from Units 12A and 12B redeemed their coupons for free non-lead ammunition. Because 107 (7%) of the hunters actually redeemed two coupons (due to a logistical error), 1,658 coupons were redeemed in 2005 (Table 5). In 2006, hunters from an additional Unit (13A) and muzzleloader hunters were added to the program. The total number of big game tags in Units 12A, 12B, and 13A was reduced by 1,000 in 2006, however. Hence, a total of 1,390 deer, pronghorn, bighorn sheep, and buffalo hunters were eligible for free non-lead ammunition in 2006. In addition, loaded non-lead rifle ammunition was offered in more calibers and grain weights and all-copper bullets were offered for hand-loaders in 2006. Program results were similar in 2006, with 832 (60%) of eligible hunters participating in the free non-lead ammunition program. Available ammunition included Federal Premium Vital-Shok cartridges loaded with Barnes Bullets, Barnes 100% copper Triple-Shok X-bullets for hand-loading, and Barnes 100% copper muzzleloader ammunition.

Table 5. Non-lead ammunition obtained by hunters through the free ammunition program in 2005 and 2006 (n/a = not available).*

Caliber	Bullet weight (grains)	Number Of Coupons Redeemed in 2005	Number Of Coupons Redeemed in 2006
Loaded rifle ammunition – 40 cartridges offered			
.243 Winchester	85	n/a*	41 (5%)
.25-06 Remington	100	44 (3%)	13 (2%)
.270 Winchester	130	343 (21%)	129 (16%)
.270 Win. Short Magnum	130	21 (1%)	9 (1%)
7mm Win. Short Magnum	160	14 (1%)	7 (1%)
7mm Remington Magnum	160	291 (17%)	128 (16%)
.308 Winchester	150	130 (8%)	31 (4%)
.308 Winchester	165	n/a	5 (1%)
.30-06 Springfield	165	n/a	101 (13%)
.30-06 Springfield	180	534 (32%)	99 (12%)
.300 Win. Short Magnum	165	n/a	8 (1%)
.300 Win. Short Magnum	180	47 (3%)	22 (3%)
.300 Winchester Magnum	165	n/a	14 (2%)
.300 Winchester Magnum	180	182 (11%)	67 (8%)
.300 H&H	180	n/a	1 (<1%)
.300 Weatherby	180	n/a	41 (5%)
.300 Remington Ultra Mag	180	n/a	26 (3%)
.338 Winchester Magnum	225	52 (3%)	21 (3%)
Hand-loading rifle bullets – 50 bullets offered			
6mm	85	n/a	2 (<1%)
.25	100	n/a	0 (0%)
.25	115	n/a	2 (<1%)
6.5mm	120	n/a	0 (0%)
.270	130	n/a	8 (1%)
.270	140	n/a	7 (1%)
7mm	140	n/a	7 (1%)
7mm	160	n/a	3 (<1%)
.30	130	n/a	2 (<1%)
.30	150	n/a	5 (1%)
.30	165	n/a	4 (<1%)
.30	180	n/a	4 (<1%)
8mm	180	n/a	0 (0%)
.338	185	n/a	1 (<1%)
Totals (for rifle cartridges and bullets)		**1658 (100%)**	**808 (100%)**

Muzzleloader ammunition – 48 bullets and 1 loading jag offered			
.45	195	n/a	0 (0%)
.50	245	n/a	2 (8%)
.50	250	n/a	0 (0%)
.50	250	n/a	12 (50%)
.50	285	n/a	0 (0%)
.50	290	n/a	9 (38%)
.50	300	n/a	0 (0%)
.54	275	n/a	0 (0%)
.54	325	n/a	1 (4%)
Totals (for muzzleloader ammunition)		**n/a**	**24 (100%)**

To help evaluate the success of the 2005 free ammunition program, AGFD worked with D. J. Case and Associates to develop two post-hunt surveys, one for non-lead ammunition program participants and one for non-participants. Surveys were mailed in November 2005 to all 2,390 eligible hunters. A total of 1,105 surveys (46%), including 943 participant (61%) and 162 non-participant (19%) surveys, were completed and returned by December 15, 2005 (D.J. Case and Associates 2006). Findings suggested that the main reasons why hunters participated in the non-lead ammunition program were: they were asked to participate by AGFD (95%); they wanted to help condors (92%); and the ammunition was free (87%). Survey results indicated that 81% of all participants used the free non-lead ammunition during their hunts. Ninety-three percent of the respondents who harvested a deer said the non-lead ammunition performed the same as, or better than, lead ammunition. In addition, 97% of the respondents who tested the non-lead ammunition stated its accuracy was average to excellent. Eighty-nine percent of the respondents said they would use non-lead ammunition again if it was provided for free, and 56% indicated that they would purchase it on their own in the future. Lastly, 72% of the respondents said they would recommend non-lead ammunition to other hunters.

Non-participant survey results indicated several reasons why hunters did not participate in the free non-lead ammunition program. Thirty percent of respondents listed their main reason as the program failing to offer their desired caliber, grain weight, or type of non-lead ammunition, and 15% indicated that the program was too complicated or a hassle (D.J. Case and Associates 2006). Forty-three percent stated their reason for non-participation as "other." "Other" reasons included: coupon was lost (15%); forgot to participate (8%); already using non-lead ammunition (5%); did not hunt (3%); and do not support this program (3%). Non-participants suggested that offering more calibers of non-lead ammunition (64%) and providing more information on condor lead poisoning (38%) would have encouraged more hunters to participate in the free non-lead ammunition program.

2005 survey results and 2006 hunter-check-station interviews, combined with the free non-lead ammunition program results, indicated that approximately 50-60% of the deer from game management units 12A and 12B were harvested with non-lead ammunition during 2005 and

2006 fall hunts as a result of the free non-lead ammunition program. Hence, voluntary lead-reduction efforts have reduced the amount of lead available to condors in Arizona. This program has also received overwhelmingly positive feedback from the hunting and environmental communities, demonstrating the merit of this ground-breaking cooperative effort. Although great strides have been made in the last five years, condor lead-exposure data suggests that the current 60% participation rate by big game hunters in Arizona may not be sufficient to sustain a healthy condor population in Arizona and Utah (see Health and Mortality sections). In response, the AGFD, TPF, and our partners plan to significantly increase hunter outreach efforts in an attempt to reach a 90-100% participation rate by big game hunters within the core condor range.

Cooperator Lead-Reduction Efforts

Since 2003, the AGFD has provided free non-lead ammunition to law enforcement officials and other professionals who may dispatch injured animals within the condor range. Project cooperators also coordinated an injured animal dispatching protocol with NPS and local law enforcement agencies in 2004 to ensure that animals dispatched with lead could be identified and removed from the field. Wildlife Services (WS) of the U.S. Department of Agriculture (USDA) Animal and Plant Health Inspection Service (APHIS) also initiated a lead-reduction protocol for their activities within the condor range (see the USDA APHIS-Wildlife Service's Activities section).

Treatment Facility

In an effort to more effectively diagnose and treat condors with high blood lead levels, the AGFD and TPF have partnered to equip and run an on-site condor treatment facility in Marble Canyon, Arizona. Condors that test positive for lead exposure in the field can now be transported to the treatment facility. Birds can receive chelation treatment and x-rays on-site. A rehabilitation pen and isolation chambers are utilized to monitor and collect fecal samples from birds being treated for lead exposure. Prior to establishment of this facility, birds had to be transported to an animal hospital in Page or Flagstaff for x-rays and treatment. Condors exhibiting clinical symptoms of lead toxicity are still transported to the Phoenix Zoo for treatment.

Comments and Recommendations

It is important to note that while the current free non-lead ammunition program is focusing on reducing the use of lead bullets in condor range, reducing the use of lead shot in condor range is also important. In Arizona, lead shot has been removed from the digestive tracts of seven condors (Parish *et al.* in press). Condor ingestion of lead bullet fragments has been associated with the fall hunting season (Hunt *et al.* in press), while condor ingestion of lead shot has been less predictable, and is not associated with a well-defined hunting season. Therefore, a free non-lead shot program would be logistically complex and probably much less effective than a free non-lead bullet program. Future lead-reduction efforts will include increased attempts to reduce the use of lead shot within the condor range. AGFD acknowledges, however, that these efforts may be less productive than lead bullet reduction efforts. AGFD remains hopeful that the voluntary use of non-lead shot will increase due to our communication efforts. There are also concerns about year-round rifle varmint hunting and the availability of non-lead ammunition for that purpose. In 2007, some non-lead .22 caliber ammunition will be available.

A significant factor in the success of voluntary lead-reduction efforts is the availability and affordability of non-lead ammunition. Although non-lead slugs and waterfowl shotgun pellets are commonly available, only a few bullet manufacturers offer non-lead rifle ammunition alternatives (Table 6), with a selection that is far less complete than that of lead ammunition. And although the recent increase in availability of non-lead ammunition gives cause for optimism, we encourage ammunition manufacturers to further expand the production of non-lead alternatives. AGFD also requests that ammunition retailers offer more non-lead ammunition for their customers. The AGFD free non-lead ammunition program will not continue indefinitely, so it is crucial that sportsmen in condor range are able to procure a wide variety of non-lead ammunition at reasonable prices. Available non-lead rifle ammunition is loaded with 100% copper Barnes X, Barnes XLC, Barnes Triple Shock X, and Barnes Solid bullets. Non-lead shot is composed of steel, tungsten, bismuth, and tin. A more complete list can be found at the California condor web page at www.azgfd.gov/condor. The impact of bonded lead/copper bullets and their fragmentation characteristics needs additional evaluation.

Table 6. Non-lead ammunition manufacturers.

Non-lead Rifle Ammunition Manufacturers	**Non-lead Shotgun Ammunition Manufacturers**
Black Hills Gold	Bismuth Cartridge
Conley Precision Cartridge	Estate Cartridge
Cor-bon Ammunition	Federal Premium Ultra Shok
Federal Premium Vital Shok	Hevi-shot
PMC Gold Line	Kent Cartridge
PMP Super Rifle Ammunition	Remington Premier
Safari Arms Ammunition	Sellier and Bellot
Superior Ammunition	Winchester
Weatherby Premium	Wolf Ammunition

Future work to reduce condor lead exposure will include expanding education and communication efforts by increasing the quantity and effectiveness of oral and written lead-reduction messages, while specifically targeting hunters and sportsmen. Future education and communication efforts will attempt to include all Arizona sportsman's groups, Arizona hunting guides, the State of Utah, Utah hunters and sportspersons, the Navajo Nation, the Kaibab Band of Paiute Indians, the Havasupai Tribe, the Hopi Tribe, ammunition manufacturers, and ammunition retailers.

Condor program cooperators also plan to incorporate strategic use of the media. AGFD will request that, beginning in 2007, the condor conservation and voluntary lead-reduction message be published in Condor Coalition member's newsletters. An attempt will be made to include the condor-lead message in other sportsmen and hunter publications as well. Messages will focus on the conservation history of hunters and commend those hunters and sportsmen's groups who support voluntary lead-reduction efforts within the condor range. The success of these efforts will therefore be dependent upon the cooperation of media organizations.

Future efforts to expand the Condor Coalition will focus on recruiting influential local and national sportsmen's groups. Because hunters consider sportsmen's groups the most credible source for information, the use of Coalition member names in hunter correspondence will be a valuable communication tool. Coalition members will also be asked to contribute to educational efforts and possibly assist in funding voluntary lead-reduction efforts.

Relevant lead research will also continue. Results from the University of Arizona lead isotope study will be published and shared with the public, as will results from the free non-lead ammunition program. Future lead research will be considered and will include fragmentation rates of newer bonded bullets (Hunt *et al.* 2000) and lead isotope studies of feathers to determine lead exposure levels and sources (Fry 2004, Church *et al.* 2005).

It is important to assess whether voluntary lead-reduction efforts in Arizona are effective in reducing the amount of lead available to condors. To accomplish this, AGFD will combine sustained condor lead-exposure monitoring with hunter surveys. TPF will continue condor lead-exposure testing to determine if lead-exposure rates decrease. A follow-up hunter awareness survey is also proposed (D. J. Case and Associates 2005) to determine if education and communication efforts have resulted in an increased awareness of condor issues and a decreased use of lead ammunition in the condor range.

ADMINISTRATION

Coordination Among Program Cooperators and Compliance with Commitments

The 1996 MOU established a framework for cooperation among the various state and federal agencies, Tribal governments, and TPF involved in the reintroduction of California condors in northern Arizona and southern Utah. Not all signature agencies/organizations had the same level of involvement in the program. This original MOU was for a period of five years.

In 2005, a new MOU was signed by the "primary" cooperators that are active in the program. The new MOU does not include original cooperators who had not been active, but it does allow for those and others to be added to the list of cooperators as needed. This current MOU was signed by AGFD, UDWR, FWS Regions 1, 2, and 6, TPF, BLM-ASDO, NPS, and USFS (Kaibab National Forest). It is also for a period of 5 years, but can be renewed based on mutual agreement. One benefit of this new MOU is that it promotes cooperation among participants for the betterment of the program by clearly defining the roles of each cooperator.

In late 2004, the chair of the SCWG was changed and representatives of the AGFD and UDWR now co-chair the committee. A liaison was also established for the California Condor Recovery Team. This change in chairs has improved administration of the SCWG with more timely minutes of meetings and follow-up on action items from the previous and current meetings to gauge progress. Since this change, regular spring and fall meetings of cooperators have taken place.

Coordination with the California program on a field level has improved due to regular meetings of field staff to share information. However, due to the lack of a dedicated national California Condor Recovery Coordinator through much of the reporting period, administrative coordination was sporadic. FWS recently assigned a new lead for this program.

AGFD provided a full time California Condor Coordinator to work with the TPF biologists on day-to-day management, and to improve outreach opportunities and program coordination.

The GRCA condor biologist left the program in 2005, and GRCA has been unable to fill this position although it is likely to be filled in 2007. This has resulted in their more limited involvement with the SCWG except on items of immediate interest. NPS interpretive staff offer daily condor education programs during the summer.

SCWG representatives have informed and briefed the Hopi Tribe, Navajo Nation, and Kaibab Band of Paiute Indians on the program and ongoing projects.

The SCWG had representatives on a subcommittee of the California Condor Recovery Team dedicated to mitigating lead availability to condors. This committee arranged for a survey of hunters within the condor range in California, Arizona, and Utah to determine awareness of the program and knowledge of lead issues. The SCWG further provided a central source for information and produced a final report to the Recovery Team.

As part of this review, SCWG participants were asked to comment on their perspectives regarding coordination and cooperation. Responses are presented below.

The UDWR has observed substantial improvement in communication and coordination between cooperators during this review period. This improvement and this has allowed for much more efficient dissemination of information to interested Utah-based agencies. Current involvement of UDWR is primarily associated with information transfer and program support. Specific initiatives and programs will be developed as needed to address condor presence in Utah.

The BLM believes that the coordination among cooperators and commitment fulfillment has been very good. Their representative is present at SCWG meetings and there is a good spirit of cooperation and information sharing among members. As a government agency with a high and ever-increasing workload, they see a great benefit in having TPF and a full-time AGFD condor biologist running day-to-day operations of the program.

Glen Canyon National Recreation Area (GLCA) believes that coordination with FWS has been great. They see opportunities for some improvement in coordination of some field operations and interactions.

The USFS (Kaibab National Forest) reported that cooperation, coordination and sharing of information among the SCWG has proceeded in an easy, effective, and informative fashion. The Kaibab National Forest appreciates and has enjoyed participating in the recovery effort.

The AGFD believes coordination among project cooperators has improved over the last five years. The twice-a-year SCWG coordination meetings have resulted in improved communication and efficiency. Since the group has been co-chaired by the state agencies of Arizona and Utah, the meeting agendas, notes, and action items have been more organized. As an example, in 2004, at the first meeting with the new chairs, all unresolved action items were reviewed, resolved, or assigned to specific working group members. In 2005, the working group finalized a new MOU among all primary cooperators. The AGFD has also provided monthly condor updates to project cooperators to improve communication. Even though coordination between primary cooperators has improved over the last five years, increased participation from other parties (e.g., the Navajo Nation and Kaibab Band of Paiute Indians) would benefit the program.

TPF reported that they are pleased with the excellent coordination among the partners now that the SCWG is co-chaired by the AGFD and UDWR. TPF acknowledges the involvement of AGFD in response to lead issues. In addition to having a full-time condor biologist on staff, the AGFD has provided financial support for a non-lead ammunition distribution program for hunters in the range of condors. TPF is also appreciative of AGFD support of research efforts. TPF believes AGFD has made tremendous strides in advancing public awareness of condors through their education programs. TPF would like to see UDWR follow suit in the near future because their participation would play a major role in the success or failure of establishing a self-sustaining population. TPF would also like the land management partners (e.g., BLM, NPS, and USFS) make significant financial commitments to help continue the work. Lead poisoning from spent ammunition proves to be the most significant obstacle to establishing a self-sustaining population of condors in the region. TPF believes the partners must work closely to find ways to eliminate the sources of lead in order for the program to succeed. TPF believes that, without the lead problem, the success of the program is assured with wild production occurring and the near elimination of some mortality factors as a result of adaptive management.

Coordination in Utah

Condors have roamed widely from their release sites in northern Arizona since the beginning of the reintroduction program. These travels have included portions of Nevada, Colorado and Wyoming, but have centered on Utah. Small groups of condors (up to 24) now regularly summer in the Deep Creek drainage near Lava Point of Zion National Park and some birds have remained in this area as late as November. The condors that summer in Utah have primarily been immature animals. In 2006, however, two condors near breeding age displayed potential territorial searching behavior in the Kolob Canyon section of Zion National Park. UDWR personnel have supported TPF biologists who are monitoring these condors by forwarding reported sighting information, assisting with retrieval of dead birds, and providing landowner contact information. UDWR personnel have also assisted with crowd-control issues when condors have come near populated areas (e.g. Cedar City). Law enforcement officers have assisted in at least one investigation involving a dead condor in Utah.

The prospect that condors would ultimately establish populations in Utah had been foreseen and the 10(j) reintroduction area, which includes nearly all of south-central Utah, was designed to take this into account. As condor use of Utah habitats increased in frequency, numbers, and duration, the SCWG sought ways to increase involvement of Utah's management agencies in condor recovery. This has been a two-step process. The first step in this process was reintegration of the UDWR into the SCWG framework. UDWR responded by assigning a primary contact who reestablished regular representation for Utah on the SCWG. In December 2004, the UDWR was assigned, along with AGFD, co-chair responsibilities within the SCWG. Utah now hosts one SCWG meeting annually and coordinates SCWG assignments with AGFD. Second, a UDWR representative was assigned to the SCWG subcommittee that develops and coordinates public relations announcements and press releases. This individual now provides Utah-specific input for press releases and media contact.

A Utah Condor Working Group was established by UDWR to coordinate with Utah's management agencies and the SCWG. This group includes representation from BLM, FWS, NPS, and USFS. The Utah sub-group acts as a liaison group for information transfer between and among Utah agencies and the SCWG. Its members have also committed to plan coordinated management strategies for condor recovery in Utah. One planning meeting has been held by the Utah Condor Working Group to discuss condor-management issues. Each of the agencies represented has expressed support for condor recovery efforts and acknowledged the need for a coordinated response to condor issues. Future planning meetings will be held to further define Utah's role in condor recovery and assure effective integration and implementation of condor recovery actions across agencies. Members of the Utah Condor Working Group now regularly attend SCWG meetings to facilitate these actions.

Additionally, UDWR has taken several other steps to increase dissemination of information on condor-related topics. A protocol for responding to reports of injured or dead condors was distributed to resource management agencies throughout the southern half of the state in

February 2004. An entire afternoon session of the 2005 meeting of the Utah Chapter of The Wildlife Society was dedicated to presentations concerning the California condor recovery program in northern Arizona and southern Utah. This provided the opportunity to educate Utah resource professionals and receive input regarding future management issues in Utah. Wildlife Services (WS) personnel in southern Utah have been informed of the presence of condors and advised of those areas in Utah that are frequented by these birds. They have committed to using extra caution when operating in those areas. Efforts to inform Utah residents have included local radio programs, wildlife shows and festivals, and a formal presentation to the Southern Regional Advisory Council, one of five bodies established by State law to allow for public involvement in wildlife management issues in Utah.

Compliance of Federal Agencies with Sections 7(a)(1), 7(a)(2), and 7(a)(4) of the Endangered Species Act

In the report for the first five-year review, this section included an extensive outline of the responsibilities for compliance with the ESA in relation to the nonessential experimental population of California condors. That report listed the responses from involved agencies regarding their knowledge of their responsibilities. That report also listed most of the section 7 consultations conducted with those agencies during the first five years of the reintroduction program. For the most part, the responses of the agencies indicated that the responsibilities were clear and understood.

However, the first five-year review also stated that because the response to the section 7 questions was uneven, it may be appropriate for FWS to issue a memorandum to the Federal agency units which clearly outlines responsibilities and identifies appropriate FWS contacts. While the recommended memorandum was not prepared, section 7 consultation has subsequently proceeded, essentially according to the outline of the first five-year review, with most of the involved agencies. However, there appears to be some misunderstanding of how the rule designating the nonessential population, the agreements that were made at the time of designation, and the section 7 responsibilities interact.

For this second five-year review, agencies were asked to report effects on land-use practices due to the presence of the condor, and to list and describe projects for which section 7 consultations were conducted during 2002-06. Responses were received from four of the involved agencies.

The UDWR responded that California condors do not frequent UDWR properties or directly impact land management actions. The UDWR indicated that condors will be considered in review of projects planned in known condor use areas.

GLCA reported that they have consulted with the FWS on approximately 15 occasions to discuss proposed projects and use of measures meant to reduce effects to condors. They indicated consultation has been streamlined and has been positive.

The AGFD reported that they receive periodic inquiries from other agencies regarding mandatory use of non-lead ammunition on public lands. The AGFD has resolved these inquiries by citing the 10(j) final rule and agreement with the counties, as well as identifying the success of the voluntary lead reduction efforts.

The BLM responded that they seem to be receiving conflicting direction from the FWS on authorizing land use practices in California condor habitat. They stated that BLM has been implementing the agreement between the counties and the FWS to not restrict land use practices in the 10(j) area based solely on the needs of condors. They have developed and are implementing conservation measures (stipulations) for land use practices that include a two-tier system. One set of conservation measures applies to users of public lands (applicants) and are optional. The other set is mandatory and applies only to BLM. They stated that the FWS has asked that BLM make conservation measures for California condors mandatory and applicable to all. BLM believes this is contrary to the agreement made by the FWS with the counties.

The USFS (Kaibab National Forest) reported that incorporation of conservation measures brought forward by the FWS has been easy to implement and they hope to be able to expand their cooperation.

FWS believes that continued implementation of section 7(a)(1) responsibilities by Federal agencies is very important in meeting recovery objectives for California condors. Through section 7(a)(2), FWS provides recommended conservation measures to action agencies that may reduce effects of project activities on condors and further recovery of the species. However, to provide better consistency in management across the 10(j) designated area, further discussions among the cooperators are needed to agree on whether to implement these measures and, if so, how and when they should be included in projects and activities.

Nonessential experimental populations located outside National Wildlife Refuge System or National Park System lands are treated, for the purposes of section 7 of the ESA, as if they are proposed for listing. Thus, for such populations, two provisions of section 7 would apply outside such lands: section 7(a)(1), which requires all federal agencies to use their authorities to conserve listed species, and section 7(a)(4), which requires federal agencies to informally confer with the FWS on actions that are likely to jeopardize the continued existence of a proposed species. Nonessential experimental populations located within National Wildlife Refuge System or National Park System lands are treated, for the purposes of section 7 of the ESA, as if they are threatened species. Thus, for such populations, two provisions of section 7 would apply within such lands: section 7(a)(1), which requires all federal agencies to use their authorities to conserve listed species, and section 7(a)(2), which requires federal agencies to consult with the FWS on actions that may affect listed species.

The final rule designating the nonessential experimental population outlines the section 7 responsibilities listed above. The special rules of the final rule do not modify those regulations.

The agreement with counties states that one of the objectives of the agreement is "to ensure to the maximum extent practicable that all current and future land, water, or air uses within the experimental population area will not be restricted due to the designation or presence of the nonessential experimental population of California condors." The agreement also contains a component that states that current land uses should not be restricted due to the designation of the nonessential experimental population, or the presence or potential presence of California condors. However, the agreement also outlines the section 7 responsibilities listed above. The agreement also states that a nonessential experimental population located within the National Park System or National Wildlife Refuge System is subject to the protection and consultation requirements of section 7(a)(2).

Integration of the final rule, section 7 responsibilities, and the agreement with counties should be as follows.

Federal agencies with lands outside of the National Park System within the nonessential experimental area are required to evaluate their discretionary actions to determine if the actions will jeopardize the continued existence of California condors. If jeopardy is not determined likely, no additional consultation is necessary. However, FWS continues to recommend that the agency request a conference, and the policies of some agencies require that they request a conference, at the may affect level. A conference at the may affect level will result in a conference report with advisory recommendations that, if adopted, would minimize effects to condors. Conferences allow the FWS to provide consistent advisory recommendations across the range of the condor population. In addition, by monitoring actions that may affect condors, FWS can better measure the effectiveness of the recommendations to the reintroduction program. Although the FWS Section 7 Handbook allows for conferences to be conducted in a manner such that conference reports can be converted to biological opinions upon listing of the species, the proposed status for this nonessential experimental population will not be changed, so that option is not appropriate for this situation.

For Federal agencies with lands within the National Park System (i.e., National Parks and Monuments, and National Recreation Areas) within the nonessential experimental area, section 7 consultation is required if an action may affect the California condor. If the agency determines that an action will not affect the condor, no further consultation is necessary. If the agency determines that the action may affect, but is not likely to adversely affect the condor, written concurrence from the Service is required. Project modification or other measures may be necessary in order to achieve concurrence. If the agency determines that an action is likely to adversely affect the condor, formal consultation is required. Reasonable and prudent measures with terms and conditions and conservation recommendations may be the result of formal consultation.

Within the nonessential experimental population area, there are no prohibitions against unavoidable and unintentional take of a California condor, provided that such take is non-negligent and incidental to a lawful activity (such as hunting, driving, or recreational activities) and the take is reported as soon as possible. However, formal biological opinions that anticipate incidental take will continue to include incidental take statements.

In order to achieve the objectives of sections 7(a)(1), 7(a)(2), and 7(a)(4), the FWS will continue to recommend conservation measures for California condors to all entities for use in development and implementation of projects. In general, the purpose of these conservation measures is to reduce the likelihood of potential take of individual condors and protect habitat in order to further recovery objectives for the species.

Condors outside of the nonessential experimental population area receive the full protection of section 7 regardless of what lands they occur on, and section 9 prohibitions against take remain in effect.

Public Support and Initiatives

Numerous individuals and organizations outside of the list of official reintroduction program cooperators continue to provide invaluable support to the program. The SCWG acknowledges and thanks the following individuals and organizations: Maggie Sacher, owner of Vermillion Cliffs Lodge, continues to provide a location for the TPF field base of operations. Her generous support of the program is punctuated by her consistent enthusiasm of the important role condor reintroduction can play in highlighting the human and natural resources of the cliff country she loves. Dr. Kathy Backus, DVM, of Kanab Veterinary Hospital, provided invaluable veterinary services in the field, and her generous provision of radiographic services and information have not only saved the lives of condors but have also contributed to an increased understanding of the dispersal and effects of lead in the environment. Dr. Kathy Orr, DVM, and her associates from the Phoenix Zoo provided invaluable service to the program through treatment of several lead-poisoned or otherwise injured condors throughout the duration of the program. Norm Freeman, director of Elemental Technologies, Inc., continues to work closely with TPF staff to arrange for the transport of captive-reared condors from the World Center for Birds of Prey in Boise, Idaho to the Vermillion Cliffs release site. Salt River Project has regularly responded to requests for helicopter flight support for the transport of condors and personnel. Arizona Public Service has designed, donated, and installed solar panels on the remote Vermillion Cliffs release site to accommodate live-feed video at the release facility. Through the Arizona Heritage Fund, the people of Arizona have provided the resources needed to create and implement a successful hunter education program and equip condors with satellite transmitters. Numerous hunter organizations and ranchers have committed through the Condor Coalition to inform their members of ways to minimize the effects of lead ammunition on condors; their efforts are demonstrating that self-motivated sportsmen groups and ranchers continue their tradition of wildlife conservation. Finally, with great pride, members of the SCWG express admiration for the enduring accomplishments of William A. Burnham (1947-2006). We are indebted to Bill for his leadership of TPF and in the conservation community. The Southwest condor reintroduction program is but one aspect of Bill's legacy to the conservation of birds of prey and their habitats.

His vision, dedication, and perseverance made the return of California condors to the Southwest possible.

Levels of public acceptance of the condor reintroduction appear to be more uniformly supportive in this reporting period (2002-06) than in the previous reporting period. During initial years of the reintroduction program, while most commenters expressed enthusiastic support for the program, some individuals and entities in northern Arizona and south-central Utah vocally criticized and even litigated against the reintroduction program, expressly criticizing FWS intentions and lack of specific commitment to accommodating their concerns in the special 10(j) rule (Arizona Condor Review Team 2002). During the current review period such objections to the program have been rare and of the comments received for this report, no such sentiments were provided by the public. We can attribute this to continued and increased SCWG cooperation with broader groups of interested parties, continued interactions by TPF field staff and other working group members with local community members, and observations of opinion leaders in resource-based economies that the program and FWS are meeting commitments under the 10(j) rule. Some community leaders that represent constituents outside of the currently designated 10(j) area and in which condors have chosen to disperse continue to emphasize that the 10(j) area be expanded. However, these individuals have not expressed objection to the reintroduction program; preliminary and visible progress on a possible 10(j) expansion may be contributing to their acceptance of the program.

Broad national, international, and local news and entertainment media coverage of the Southwest condor reintroduction has waned since the initial releases of condors. This has presumably resulted from reduced novelty, diminished controversy, fewer unlawful condor casualties, and steady success associated with the condor reintroduction program. However, unique and benchmark events in the program – such as first egg laying and fledging – have generated flurries of broad interest. As a result, the SCWG and its members have focused news releases and news media opportunities on such events. The logistics of providing news-crew access to remote wilderness sites, and concern over disturbing condors as a result of media access and the public dissemination of exact breeding location information, have been deterrents to media coverage of recent newsworthy program accomplishments. Initial photographic images of fledging and egg laying sites have been of low quality due to limited accessibility of these locations even for reintroduction-program personnel, yet newsworthiness of these events still resulted in news coverage and publication of these photographs. TPF and AGFD have readily made photographic images available. Television news producers have requested that a more concerted effort be made to gather video images of such program events. Assessments of viewership/readership of condor reintroduction news products and public attitudes (nationally or locally) have not been conducted.

Longer-term and more in-depth information products have been produced and well received. In September 2005, AGFD's Chuck Emmert and TPF's Chris Parish won an Emmy award from the National Academy of Television Arts and Sciences for an Arizona Wildlife Views segment entitled "As Curious as a Raven." The segment aired on PBS stations KAET-TV and KUAT-TV in the Phoenix and Tucson media markets in September and October 2005, and DVDs of the production are used by working group members during presentations.

News media coverage of annual condor releases at the Vermillion Cliffs in 2002-06 has been sporadic and limited to coverage in the Salt Lake City, Phoenix, and Flagstaff media markets. Annual condor releases (now conducted January to March) continue to draw 100-200 attendees. While the number of attendees is significantly less than that of the initial condor release, the opportunity to be a part of this aspect of the program is greatly appreciated and popular among local residents and regularly attracts destination visitors from Flagstaff, Kanab, and St. George and occasionally bird watchers from as far as California and Wisconsin.

Throughout the year, travelers and bird watchers use the condor-release viewing facility in House Rock Valley. TPF uses the area for staging information meetings with interested groups. Improvements to the area have been made. However, as noted by an area grazing allotee, people are coming to view condors and are frustrated and need to be accommodated; repairs and facility updates are needed. The BLM has finalized plans to construct a new viewing area below the release site which will include parking, a new shelter, restroom, and fence around the site.

Staff at public land visitor centers within the reintroduced area report continued or increasing visitor interest in condor viewing. At BLM offices in St. George and Kanab, and at GLCA visitor centers, public interest is fairly high and employees in the visitor center respond to questions routinely. BLM brown-bag lunch programs and other speaking engagements on the condor are well attended. At GLCA, condor pamphlets have proven to be one of the most popular handouts and visitor-service personnel report that visitors often wish to view condors in the wild. Many explain that the chance to view a condor was one reason they chose to vacation in the area. The review team received requests for additional and more current condor information for visitors at the North Rim of GRCA, Kaibab Lodge, Jacob Lake, and Vermillion Cliffs Lodge. The SCWG will consider providing monthly condor reports and distribute information to these facilities to assist with the information demands of staff, interpreters, and visitors. As a result of GRCA staff requests, TPF and AGFD will again provide interpretive training at the North Rim in spring 2007.

Most SCWG members and personnel from working group agencies/organizations deliver presentations regarding the condor to service organizations, school groups, and visitor centers at varying frequency. TPF continues to provide presentations in communities throughout the range of the released condors and contributes greatly to the support and training of interpretive programs at public facilities throughout the range (and increasingly in the State of Utah as released condors expand into the state). GRCA and AGFD have substantially increased and improved their outreach efforts in the 2002-06 period.

Although visitors come to GRCA because it is one of the natural wonders of the world, once they have arrived, more often than not, it is the story of the California condor and its successful reintroduction that holds their interest and compels them to find out more about the canyon.

During the last five years, GRCA at the South Rim has attempted to implement a focused approach to communicate the condor reintroduction story to the widest audience possible. From April to October, GRCA offers one to two formal interpretive programs daily that focus on the current condor program and its successes and challenges. These programs contact approximately 15,000 visitors per year. Approximately 25 times a year, evening programs are offered that take visitors on a visual representation of the condor reintroduction. This typically reaches a total of 2,000 visitors per year. The GRCA environmental education department has created a specialized program for children that delves into the challenges of raising condors in captivity and reintroducing them to a more wild setting. A program for kindergarten to second grade reaches approximately 500 children a year and a daily summer program focuses on older children and reaches approximately 1,500 a year. During periods of peak condor activity at the South Rim, GRCA often has a ranger work at an observation station and provide short, 5- to 10-minute programs throughout the day on the condor. GRCA has provided this service for the previous two years, contacting over 2,500 visitors a year during this process. In addition to formal interpretation, staff answer questions about the condors numerous times each day and provide additional short programs on the species (averaging about 5,000 contacts per year). In 2006, GRCA added a mounted condor specimen to the visitor center. It was placed directly over where most interpretive programs (including geology, history, etc. programs) are presented. As a result, most programs involve a short question and answer period involving the condor. In the six months after it was installed, South Rim staff reached over 15,000 people with some portion of the condor story.

The GRCA interpretive division takes great pride in providing accurate information on the species. Over 25% of the formal interpreter training in 2006 was spent on condor-related issues. In the winter of 2007 GRCA will send six interpreters to the San Diego Zoo for training on condors. In short, at the South Rim of the Grand Canyon, GRCA treats the condor story as one of the main interpretive themes and makes a consistent effort to communicate that story to the public. In total, GRCA staff reached just shy of 200,000 people during the last five years with interpretive personal services relating to the condors at the South Rim of Grand Canyon.

Additionally, condor program volunteers stationed at GRCA informally provide interpretive services. One volunteer reported spending over 1,400 hours in voluntary field work for this program during the last three years. Many of these hours have been spent interpreting condor biology, behavior, and the recovery program, to several thousand GRCA visitors. TPF field staff also provide impromptu interpretation to visitors when working at GRCA.

AGFD has significantly increased outreach efforts in the last five years. Outreach efforts have included condor presentations to general audiences as well as sportsmen’s groups, condor booths at wildlife and sportsmen’s fairs, and letters to big game hunters. During 2002-06, AGFD averaged approximately 40 condor presentations, five condor education booths, and 6,000 letters to sportsmen reaching well over 10,000 people annually. The AGFD-led effort to develop a hunter-education and non-lead-ammunition program to reduce lead exposure to condors is a substantial outreach effort and is described in full in the Lead-Reduction Efforts section of this report. This program in itself has been reported broadly in the news media (particularly California news markets) and has gained a tremendous amount of interest and support within sportsmen, environmental, and land-management groups.

During the second five-year review process, repeated requests for increased participation in environmental education programs were received (although not from professional educators). Suggestions included use of condor satellite telemetry data in the AGFD Focus Wild curriculum to increase exposure of the program in schools, teach natural sciences and math lessons, and allow students to be the conduit for information to parents. AGFD will explore the need for and feasibility of such a program.

In the past five years, the SCWG and individuals interested in the condor reintroduction program have increasingly relied upon the internet to disseminate and receive condor program information. Web sites and pages that fill this need include TPF's www.peregrinefund.org/released_condorsinfo.asp, FWS's www.fws.gov/southwest/es/arizona/CA_Condor.htm and www.fws.gov/endangered/i/B0G.html, BLM's www.blm.gov/az/asfo/wildlife/condor.htm, AGFD's www.azgfd.gov/condor, and GRCA's www.nps.gov/archive/grca/pphtml/2highlights94.html.

As the range of the reintroduced California condor population has expanded in the past five years, so too have outreach efforts. In Utah, several outreach efforts have been undertaken opportunistically during the past five years, but no condor-specific publicity/outreach programs have yet been developed (but see the Coordination in Utah section for efforts that have been made). National Parks in southern Utah can greatly benefit by modeling their interpretive programs on those developed at GRCA as condors increasingly frequent Utah sites and visitor demand for information increases. Pursuing an effort to increase the 10(j) area (see the Administration – Expansion of Nonessential Experimental 10(j) Population Area section) would demand an increased commitment of outreach efforts by the working group and an expanding list of future partners. The SCWG recognizes that continued support for the management of condors, particularly in areas where the condor range is expanding, requires substantial early outreach efforts.

As part of this review, SCWG participants were asked to provide information regarding their perspectives on public acceptance and interest. Responses received are below.

UDWR stated that southern Utah publics seem to be supportive of the California condor recovery program. Utah citizens are curious about condors and enjoy seeing them. They are interested in the birds, if a bit hesitant to give full, unconditional support to the recovery program. The non-essential experimental designation has done much to ameliorate concerns about the possible impact of a listed species on normal land use and recreational activities.

BLM reported that public acceptance, especially among the local citizens and project proponents, is favorable due to the 10(j) status and lack of use restrictions based solely on the condor. Public interest is fairly high. Tour groups and individuals regularly stop at the Vermillion Cliffs viewing area. Employees in the visitor centers routinely field condor questions. Brown-bag lunch programs and other speaking engagements on the condor are well attended.

GLCA received a large number of condor pamphlets from the AGFD. These have proven to be one of their most popular handouts. They often hear from visitors that wish to view condors in the wild. Many visitors explain that the chance to view a condor was one reason they chose to vacation in the area.

The USFS (Kaibab National Forest) reported that public interest in condors has consistently been expressed by their guests at the Jacob Lake Visitor Center and the House Rock Valley overview along Highway 89A, and occasionally by visitors met on the Kaibab National Forest. Outreach efforts have been limited to displays and information-sharing at the Jacob Lake Visitor Center.

TPF believes public acceptance of the overall program has been very positive, but raising the necessary funds to support the release and monitoring effort remains a significant challenge.

Economic Opportunities

Most businesses in the immediate proximity of the condor release area are heavily reliant on outdoor recreation and tourism (Grand Canyon viewing, hiking, river running and trout angling, and supporting lodging, dining, and guide services). Local business owners and public lands managers continue to note that condor presence in the area provides "value added" to the selection of this area as a visitor destination. An appreciable number of visitors do not schedule trips for the sole purpose of seeing condors, although some businesses have reported that clients have extended their stay in the area to include a condor viewing experience. GRCA reports that only a small number of visitors come to the park to view condors, yet upon arrival the majority of surveyed visitors stated that condor viewing was the most memorable feature of their visit. Extended visits and side trips to areas for condor viewing undoubtedly result in increased spending in the area. Some condor-viewing destination travel is known to occur (particularly resulting from condor releases and for bird watchers in pursuit of untagged condors – such as recently fledged birds at GRCA) creating economic stimulus that is solely attributable to the condor program. However, the extent of resulting increased visitors is unknown and their length of stay and trip spending has not been ascertained. Similarly, as the range of the introduced condors expands to additional tourist destinations, visitor spending is likely to increase.

Marketing condors as a visitor destination feature is not within the current scope of the SCWG. However, the group recognizes the potential for such commercial and regional interest in such efforts and is prepared to consider the effects to the program and how the program could prudently accommodate such interest.

Condor field crews and SCWG members also contribute to local economies through fuel, grocery, meal, and occasional lodging purchases. If 10(j) area expansion efforts and condor range expansion continue to occur, spending by project participants will increase in volume and area.

Due to the nonessential experimental 10(j) population designation, land-use restrictions and resulting economic costs to local economies have not been realized and are not anticipated.

Law Enforcement

Clarification regarding jurisdictions and responsibilities of the major land-management agencies involved in the reintroduction process was included in this section in the first five year review (Arizona Condor Review Team 2002). Please see that report for the information.

The first five-year review recommended that the partners in the program review the law-enforcement protocols and include coordination as a priority in order to ensure complete and timely cooperation pertaining to incidents involving condors. The suggested review was expected to result in: 1) revised protocols; 2) field forensic training for personnel; 3) improved coordination among law enforcement personnel, field biologists, and public affairs personnel, and the development of a "contacts" list; 4) defining a balance between the need to manage surviving condors and compromising an investigation; and/or 5) better communications and response from the FWS Forensic Laboratory.

The SCWG conducted the recommended review during the reporting period. The review resulted in a *California Condor Injury/Mortality Protocol*, a *Dispatch (Arizona and Utah Radio Rooms) Procedure for an Injured or Dead California Condor*, and a *Procedure for Submitting Free-Ranging California Condors for Postmortem Examinations*. These protocols and procedures are intended to increase the effectiveness and efficiency of law enforcement and forensics responses to injured or dead California condors that are discovered in the field, and they have been distributed to the appropriate personnel. With the development of these procedures and other discussions, the SCWG believes the law enforcement issues have been sufficiently addressed. No other outstanding issues with law enforcement procedures or implementation occurred during 2002-06.

During the reporting period, two California condor deaths were investigated by the FWS Office of Law Enforcement. Both of the condors were found dead in northern Arizona in September 2002. Examination results from the FWS National Fish and Wildlife Forensics Laboratory confirmed that Condor 258 died as a result of being shot with a shotgun and that Condor 186 died after being shot with an arrow. The investigations of these two condor deaths are still open.

Aviation

Air safety is of critical importance to both human safety and to the condor recovery program. As the Grand Canyon Ecoregion serves as a high-density tourism area for sight-seeing flights, every precaution to eliminate near misses and collisions with tour and administrative flights must be addressed.

Over areas of designated wilderness on BLM lands, aircraft are advised to be 2,000 feet above ground level, but this is not an enforceable requirement. Over GRCA, air tours and overflights have been a concern for years primarily because of noise-related issues, and the Grand Canyon National Park Special Flight Rules Area has been established to regulate overflights up to 18,000 feet above sea level. The Special Flight Rules Area is focused on the GRCA but extends somewhat over adjacent land ownerships. Aircraft flight corridors and flight-free zones have been established. There are FAA regulations governing how flights operate, and operators also have been provided information regarding the presence of condors in the area. In the ten years of the condor reintroduction program there have been no reported condor strikes or near misses by air-tour operators. In some cases, condors have become one more interesting resource that air-tour pilots can mention to their customers.

Agency aircraft, when conducting agency missions such as fighting fires, search and rescue, or game surveys, may fly relatively close to the ground and along canyon rims. At times, due to how and where these aircraft operate, there is a potential for conflict between the condors and these aircraft. Special care needs to be taken by agency personnel to be aware of the possibility that condors may be in the area. GRCA developed an observation record for their Fire and Aviation Program that records near misses and flight path diversions. A few diversions of GRCA administrative helicopter flights occurred during the early years of the reintroduction program. During that time, condors would occasionally gather around the dip tank at the North Rim helibase. The tank has since been covered and there have been no reported diversions in the past three years. In the past five years, condor-aviation conflicts in GRCA have not been a problem. A Resource Advisor should be present on wildland fires involving aircraft. One of the functions of the Resource Advisor is to be aware of possible condors in the area and alert aircraft personnel.

A number of military aviation training routes exist in northern Arizona and southern Utah. However, these routes have not imperiled any condors to date. The first five-year review (Arizona Condor Review Team 2002) recommended that the Air Force be advised of all existing and future condor release sites, and possibly other condor concentration sites, in order to have these locations marked as hazards on military training route maps (specifically the Department of Defense flight planning publication AP/1B which is published twice annually). Nellis Air Force Base did not respond to inquiries as to their awareness of condors.

Prohibitions in the Airborne Hunting Statute 16 USC 742j-1 that pertain to condors include:

> Use of "…aircraft to harass any bird, to shoot or attempt to shoot any bird. Penalties include $5,000 fine and/or 1 year in jail. Forfeiture of all birds, fish or other animals shot or captured contrary to the provisions of this section… and all guns, aircraft, and other

equipment used to aid in the shooting, capturing or harassing shall be subject to forfeiture to the United States."

In the past five years there have been a few incidents of aircraft flying near the release site, but none that could be considered illegal. One incident in the first five years of the program regarding the harassment of condors by aircraft resulted in a fine to a helicopter-tour operator. In addition, military or civilian aircraft have either flown low near the condors or been spotted flying low over designated BLM wilderness areas and NPS-administered areas. However, the observers have not always secured information necessary to identify the aircraft. The SCWG recommends that all condor field personnel report all potential condor/aviation incidents and be trained to record aircraft identification numbers, and be knowledgeable of wilderness or special land management aviation guidelines and other pertinent information. A review with air tour operators should be conducted on an annual basis to ensure compliance with the Airborne Hunting Statute and potential violation of the ESA.

There is an existing airport adjacent to Navajo Bridge which is a location frequented nearly year round by condors. Due to wind conditions, planes sometimes take off toward the bridge but no adverse condor/aircraft interactions have been observed to date.

USDA APHIS-Wildlife Services Activities

WS has conducted predation management efforts in southern Utah and on the Arizona Strip annually, including lands administered by the BLM. All WS activities are conducted pursuant to National Environmental Policy Act (NEPA) documents prepared by the program under APHIS implementing guidelines. For the most part, WS activities have consisted of coyote predation management for the protection of cattle and calves or to improve mule deer and pronghorn fawn survival. Some efforts in both states have addressed human safety concerns associated with mountain lions (*Felis concolor*) or, in Utah, black bears (*Ursus americanus*).

When discussing condor reintroduction efforts, predation management activities by WS on the Arizona Strip have often been perceived as an issue (and were raised as part of the original 10(j) rule). Due to these concerns, WS activities were carefully evaluated as part of the first five-year review of the condor reintroduction program in northern Arizona. During the period of actual experience beginning December 1996 to present, no conflicts between condors and WS activities have been noted.

WS activities on BLM or National Forest system lands within the 10(j) area are conducted pursuant to national level MOUs between APHIS and the respective land managing agencies. All field activities are further conducted under a work plan developed by WS that considers resources under the jurisdiction of the land managing agency. All predation management activities on BLM lands on the Arizona Strip in the last five years have been in accordance with the national MOU between BLM and WS and the local work plan. For lands within the Escalante/Grand Staircase National Monument, a work plan has been developed between the

State of Utah and the Monument that parallels the process contained in the APHIS-BLM MOU. WS is not a party to the existing condor reintroduction MOU.

Since the first California condors were released in 1996, WS has consistently contacted BLM prior to initiating their planned work on the Arizona Strip in order to accommodate BLM resource and safety management concerns. Special attention has been given to the condor reintroduction program. WS personnel have also contacted TPF each time to ensure the condors were adequately protected.

WS aircraft used in aerial gunning are typically fixed-wing and fly close to the ground. Aerial gunning works best and is only applied in relatively large, flat, open, treeless expanses. It is not attempted in areas with significantly rough terrain or heavy vegetative cover. Certain areas, identified annually or as needed by TPF, are not flown by WS in order to avoid any possible aerial conflict with the condors. Additionally, WS has committed to reporting birds if they are observed, and TPF has provided information about missing birds and transmitters on occasion.

WS has committed in its environmental assessments (EA) to mitigation to prevent possible conflicts with all uses, including accommodating endangered species needs. The WS aerial gunning program on the Arizona Strip and in the Escalante/Grand Staircase National Monument employs only non-lead pellet shot fired from shotguns aboard the aerial platforms. Coyotes removed by ground shooting are taken from the field or otherwise made unavailable to condor scavenging so there is no risk of lead poisoning from the WS program.

WS was sued in Federal court over the use of the M-44 device outside of the 10(j) area in 2000. In 1983 a condor was reportedly killed by an M-44 device set by FWS employees in California. Apparently two M-44 devices were set out approximately 30 feet apart. The first one attracted and killed a coyote, but the coyote moved close to the second device before it died. The condor was attracted to the body of the dead coyote and was killed by the second M-44. As a result, the FWS has provided terms and conditions on the M-44 device to both the Environmental Protection Agency and WS as part of section 7 consultations. WS has incorporated these restrictions outside of the 10(j) area in specific corridors as part of the settlement to the 2000 lawsuit. Additionally, the M-44 device is not available for use in Arizona, in National Parks or Monuments (such as the Parashant, Vermillion Cliffs or Escalante/Grand Staircase) or in National Recreation Areas (e.g., GLCA and Lake Mead National Recreation Area). Restrictions on the areas where the device can be used, along with the terms and conditions identified by the FWS in section 7 consultations, should preclude any risks to condors from this method.

WS also calls and shoots by rifle some predators, chiefly coyotes, from the ground. While the rifle bullets used vary, they are generally small, fast, highly-frangible copper-jacketed hollow-point bullets that contain lead. As noted above, coyotes removed by ground shooting are removed from the field or otherwise made unavailable to condor scavenging so there is no risk of lead poisoning from the WS program.

Because coyotes are scavengers as are condors, and at BLM's urging, in 1999 WS had seven samples of coyote liver tissues collected on the Arizona Strip west of Kanab Creek analyzed for lead. Six of the seven had no detectable levels of liver lead concentration; one sample had 52 µg/dl. WS has agreed to participate in future monitoring, as appropriate, to assist the project in determining lead risks.

There have also been additional efforts by WS in the 10(j) area outside the Arizona Strip. For example, WS has conducted aerial gunning operations for coyotes in the spring for three consecutive years north of Flagstaff in order to increase pronghorn fawn survival rates. WS has been involved in the capture and removal of problem mountain lions in the Mt. Elden area north of Flagstaff as well as the capture of mountain lions for research near Flagstaff and in Zion National Park. WS conducts seasonal coyote predation management in cattle areas in southern Utah, generally at times when condors are not present. WS also conducts sheep protection activities in southern Utah throughout the year. WS activities are addressed in their EAs and section 7 consultations and the FWS has concurred that these activities are not likely to jeopardize condors.

WS has the statutory authority to manage and prevent wildlife damage, including predation management to protect livestock. Recognizing that WS will continue to conduct predation management in the condor reintroduction area, and that good communications between the WS and the condor reintroduction program is essential, we recommend that WS be invited to become a condor program cooperator and party to any revised MOU.

Expansion of the Nonessential Experimental 10(j) Population Area

When the 10(j) rule was published in the *Federal Register* in October 1996 (61 FR 54044-54059), most specialists believed that the designated area would be large enough to adequately contain the condor population. However, the discussion of issues within the *Federal Register* rule (Issue and Response 14; 61 FR 54055) acknowledged that should the designated area prove inadequate, FWS has the option to revise the rule to increase the size or change the configuration of the area.

By July 1998, condors were confirmed outside the current 10(j) area and since that time there have been other instances to the north, east, west and south of the 10(j) area. Initially, these flights appeared to be experimentation by new birds, and the longest travels still fit into that category with birds either returning or being lost. However, over the past three years a significant increase in condor use has occurred in the Kolob and Cedar City areas of Utah, and in spring 2006 individuals appeared to be exploring nest caves in this area.

The first five-year review of the program "strongly" recommended that the existing California condor nonessential experimental population area be broadly expanded "as soon as possible." The report continued that the "10(j) expansion could be accomplished to include all five states in one Federal rule-making process, with measurable progress before the end of Fiscal Year 2002."

The SCWG approached the Western Association of Fish and Wildlife Agencies regarding this expansion option, and the states of Utah, Arizona, New Mexico, Colorado, Wyoming and Nevada assigned liaisons to the group to continue discussions. The Navajo Nation joined the discussions. Throughout early- to mid-2006, discussions occurred with these states and the Nation to gauge their interest in an expansion proposal to include all or portions of their states and the Navajo Nation. The SCWG formally submitted a concept expansion proposal to both the California Condor Recovery Team and the Arizona Field Supervisor for FWS at the end of September 2006. This proposal requested designation of one representative for the three FWS regions involved in the potential expansion area and offered assistance from workgroup members in the expansion rule process. This expansion proposal would only be for natural expansion of the birds outside the original 10(j) area and would not propose release sites outside the original area. Currently, this proposal is being considered by FWS for further action and funding.

Project Costs

Partners of the condor reintroduction program were asked to provide information regarding funds or other in-kind goods or services that were expended on the program during the review period (2002-06). Responses received are summarized below.

TPF reported spending $6,163,827 during the reporting period on propagation and release efforts for the Southwest reintroduction effort. That sum is an increase of $1,677,585 million over the $4,486,242 expended during the previous reporting period. During the reporting period, TPF received $1,984,939 from Congressional appropriations through the FWS, $140,000 from AGFD, and the remainder from private donations solicited by TPF.

The AGFD has employed a full time condor biologist since 2002 and has also expended extra funds in the last five years to supplement lead-reduction efforts. The AGFD budget for the last five fiscal years (July-June) totaled (total costs):

2002	Condor biologist operating costs	$51,800
2003	Condor biologist operating costs	$62,200
2004	Condor biologist operating costs	$70,300
	6 satellite transmitters and data download	$25,000
2005	Condor biologist operating costs	$86,700
	15 satellite transmitters and data download	$54,500
	X-ray machine and developer; veterinary lab equipment, trailer to haul calf carcasses, two chest freezers to hold carcasses, three telemetry receivers, 11 Personal Data Assistants and field data entry system	$40,500
2006	Condor biologist operating costs	$68,200
	Satellite transmitter data download	$8,500
	10 spotting scopes and tripods, field lead test equipment, video equipment, lab equipment, and telemetry receiver	$11,500
	Free non-lead ammunition program	$104,900

For the UDWR, California condor recovery obligations have been met through reallocation of existing budgets and personnel. Annually, this has required the commitment of approximately 0.1 FTE ($6,500) and current expense expenditure of approximately $750.00. Personnel and budget commitments will increase as condors become established in Utah.

The BLM-ASDO budgets approximately $6,000 per year for transportation of condors. This is typically used to bring condors from the breeding facility in Boise to the release site. ASDO has also organized vehicles and personnel to get the condors from the viewing area to the release pens. This effort was not undertaken in 2006 due to two small releases of six birds rather than one large release of around twenty birds as had been done in previous years. The ASDO condor lead biologist's time budget in fiscal year 2006 was equivalent to $5,881. The ASDO has committed $40,000, including approximately $27,000 in Challenge Cost Share dollars, to construct a new viewing area below the release site that will include parking, a new shelter, restroom, and fence around the site.

The USFS (Kaibab National Forest) reported an expenditure of approximately five days ($1,700) of staff time per year on meetings, consultations, and outreach with the public and USFS personnel.

GLCA reported that approximately 40 hours at $40 per hour ($1,600) were expended as labor costs for section 7 consultations over the last five years.

The Arizona Ecological Services Office of the FWS provided approximately a 0.15 FTE each year from 2002 through 2006 at an annual cost of approximately $11,000. That total represents condor-related activity including participation in the SCWG, recovery actions, section 7 consultations, and outreach.

Research Needs

It is critical that the ecological aspects of the condor recovery efforts be given high priority. It is not merely enough to "preserve" the species; we must examine and collect the appropriate data on distribution, abundance, and ecological relationships of the California condor. We must ensure that survival, reproduction, and recruitment are stable in order to reach a long-term goal of a viable, self-sustaining population of condors in the wild.

On the Colorado Plateau, there are many information needs pertaining to the biology of the condor. Major research endeavors require a detailed study plan and careful experimental design to obtain meaningful results. Research priorities and expenditure of limited financial resources and field-biologist time must be determined in coordination with local information needs and overall condor recovery program issues. The following table is a summary of how the research needs identified in the first five-year review have been addressed during the second five-year period.

Table 7. Summary of recommendations for research from the first five-year review and accomplishments in the second five-year period.

Recommendation	Action	Reference In This Document
Collect data on condor flight corridors, activity areas, and flight elevations.	Data have been collected and analyzed through 2006, and results through 2004 have been reported (Hunt *et al.* in press). Some data collection and analysis is ongoing.	See the Movements section.
Collect data on food base distribution, seasonality, cause of death, abundance.	Data are collected continuously and analyzed annually. Research is ongoing.	See the Lead Reduction Efforts section.
Assess toxicity of copper-jacketed bullets using non-target species. Assess potential lead exposure pathways.	Some research has been initiated and accomplished. Research is ongoing.	See the Lead Reduction Efforts section.
Collect pair bond, flock social structure, dispersal, and foraging pattern data.	Data are collected continuously and analyzed annually. Research is ongoing.	See the Reproduction and Lead Reduction Efforts sections.
Collect habitat use data: nesting, roosting, perching preferences.	Data are collected continuously and analyzed annually. Research is ongoing.	See the Movements and Reproduction sections.
Collect data on interspecies relationships.	Interactions are recorded as they are observed. There is no directed research effort for this item.	See the Mortality section
Document nest-predator interactions.	These incidents are recorded as they are observed. There is no directed research for this item.	See the Mortality section.
Collect nest site data: cave/ledge size, etc.	Data are collected continuously and analyzed annually. Research is ongoing.	See the Reproduction section.
Collect data on aircraft overflights and condors.	Aircraft flight routes are generally known and can be compared to condor flight routes.	See the Movements section.
Collect data on condor impacts from human recreational activities.	Specific interactions are recorded as they are observed. There is no directed research effort for this item.	See the Law Enforcement section.

FUTURE RESEARCH AND MANAGEMENT NEEDS

It is increasingly apparent that the ultimate success of the reintroduction program will benefit from a substantial reduction in the incidence of lead exposure. Lead and the associated need for monitoring condor movements therefore remain the principal topics of the TPF condor research program. TPF plans to:

- Develop methods for assessing the lead-exposure history of individual condors.
- Evaluate lead loads in carcasses available to condors.
- Analyze the relationships between movements and lead levels with particular emphasis on the increasing use by condors of the Zion region of southern Utah.
- Monitor condor locations relative to carcass distribution.
- Investigate factors influencing condor nest success.
- Monitor and evaluate condor behavior and management methods aimed at improving errant behavior.
- Monitor and evaluate relationships between lead fragments and blood lead levels found in condors.
- Determine the long-term implication of repeated lead exposure to, and the impacts of multiple chelation treatments on, condors.
- Continue to investigate the occurrence and effects of other contaminants that condors may be exposed to.
- Model the demography of the population with recent data.

In addition to the above, the SCWG recommends the following research:

- Analyze feather lead isotopes to see if time of lead exposure can be determined.
- Evaluate fragmentation characteristics of additional bullet types (e.g. bonded bullets).
- Conduct follow-up surveys of hunters to determine the efficacy of outreach efforts.
- Determine how to engage varmint hunters in lead-reduction efforts.
- Evaluate the toxicity of bismuth and copper varmint-caliber bullets.

Accomplishment of Recovery Tasks

The recovery strategy for the California condor is to focus on: 1) increasing reproduction in captivity to provide condors for release; 2) releasing condors to the wild (to establish two geographically separate, self-sustaining, free-flying condor populations); 3) minimizing condor mortality factors; 4) maintaining habitat for condor recovery; and 5) implementing condor information and education programs (U.S. Fish and Wildlife Service 1996b). With the reintroduction of California condors in northern Arizona, number 2 has been initiated. As discussed in several sections throughout this report, numbers 3 and 5 have been initiated through implementation of a variety of actions.

The recovery outline of the recovery plan includes several tasks to be completed or implemented. The following specific tasks from that outline have been initiated and are ongoing efforts in the reintroduction program in northern Arizona.

2. Reintroduce California Condors to the Wild

    24. Following the procedures outlined in tasks 21 through 23, implement releases of California condors outside California.

        241. Release California condors in northern Arizona.

4. Minimize Mortality Factors in the Natural Environment.

    43. Implement management recommendations and strategies to minimize contaminant-related mortality factors.

    44. Eliminate or reduce the effects of environmental contaminants on California condor.

    45. Monitor contaminant levels in California condors.

5. Implement Information and Education Programs on Condor Habitat Use and protection Needs.

    51. Distribute educational material about condor habitat, species identification, and legal protection.

    54. Establish observation points and educational facilities at selected sites.

Attaining a successful reintroduced population of California condors is essential to meet recovery plan objectives for the species. The minimum criteria for reclassification of the California condor to threatened is maintenance of at least two non-captive populations and one captive population. These populations: (1) must each number at least 150 individuals, (2) must each contain at least 15 breeding pairs, and (3) be reproductively self-sustaining and have a positive rate of population growth. In addition, the non-captive populations (4) must be spatially distinct and non-interacting, (5) must contain individuals descended from each of the 14 founders. The condor reintroduction program in the Southwest is part of the effort to attain these goals.

CONCLUSIONS AND RECOMMENDATIONS

The first five-year review indicated that cooperators in the California condor reintroduction program in the Southwest expressed a very high level of satisfaction with the reintroduction program (Arizona Condor Review Team 2002). The program was also widely considered to be an unprecedented success. No entity recommended termination of the program. The review team unanimously recommended continuation of the California condor reintroduction program in the Southwest to the California Condor Recovery Team and FWS.

The first five-year review also included several recommendations for administration, coordination, and field management. Tables 8 and 9 summarize the implementation of those recommendations and include a reference to where the relevant information can be found in this document.

Table 8. Summary of administration and coordination recommendations from the first five-year review and accomplishments in the second five-year period.

Recommendation	Action	Reference In This Document
Proceed with 10(j) expansion.	A proposal has been drafted and is under consideration.	See the Expansion of the Nonessential Experimental 10(j) Population Area section.
Secure all permits required by management agencies.	All cooperating entities have agreed to obtain all necessary permits per the MOU.	
Develop a new MOU and conduct annual cooperator meetings.	A new MOU was signed in 2005. The SCWG meets twice a year.	See the Coordination Among Program Cooperators and Compliance with Commitments sections.
Develop stronger partnerships with tribes in northern Arizona, Kaibab National Forest, UDWR, management agencies in Utah, and WS.	The condor program is discussed during annual AGFD coordination meetings with the Kaibab Band of Paiute Indians, the Navajo Nation, and the Hopi Tribe. Other mentioned entities are members of the SCWG. BLM coordinates with WS, and WS has expressed interest in more active participation	See the Coordination Among Program Cooperators and Compliance with Commitments sections.
Develop new law enforcement protocols.	Accomplished.	See the Law Enforcement section.
Identify opportunities for increased public education and outreach.	All agencies are currently coordinating outreach efforts, and looking for new education and outreach opportunities.	See the Lead Reduction Efforts (Education and Communication) and Public Acceptance and Interest sections.
Encourage development and availability of non-lead ammunition.	AGFD has provided free non-lead ammunition to selected hunters for two years. UDWR has stopped using lead ammunition in the 10j area for wildlife hazing activities.	See the Lead Reduction Efforts section.
Initiate condor-lead ammunition hunter awareness program.	Efforts were initiated in Arizona in 2003 and are ongoing.	See the Lead Reduction Efforts section.

Recommendation	Action	Reference In This Document
Initiate research into lead pathways; identify lead exposure sources.	This research has been initiated and is ongoing.	See the Lead Reduction Efforts section.
Coordinate with utility companies; mark critical transmission lines.	Identified areas of concern on the South Rim of GRCA have been marked.	
Coordinate with Federal agencies regarding section 7 and 10(j) rule of theESA.	Section 7 consultations have been conducted as needed and process is ongoing.	See the Compliance of Federal Agencies with Sections 7(a)(1), 7(a)(2), and 7(a)(4) of the Endangered Species Act section.

Table 9. Summary of field management recommendations from the first five-year review and accomplishments in the second five-year period.

Recommendation	Action	Reference In This Document
Continue management flexibility to respond to new challenges.	As new information and knowledge are obtained, they are incorporated into the program by the SCWG as appropriate.	
Continue intensive monitoring and individual bird assessment.	Ongoing.	See the Biology and Management section.
Establish a medical treatment facility near the release site.	Accomplished. The facility was fully functional as of 2005.	See the Treatment Facility section.
Expand use of satellite telemetry and GPS units.	On average, up to one-third of the population is fitted with these units.	See the Monitoring and Data Collection section.
Intervene to prevent birds from being compromised due to behavioral or health reasons.	Ongoing.	See the Biology and Management section.
Continue to hold birds in flight pen for more than six months prior to release.	Ongoing.	See the Biology and Management section.
Increase the use of adult mentor birds for juveniles in flight pen.	Initiated and ongoing.	See the Biology and Management section.
Continue providing contaminant-free carcasses at release site and dispose of remains.	Ongoing.	See the Biology and Management section.
Develop data management procedures for consistency, prompt entry into computer, organized retrieval and analysis. Allow biologists time for data entry.	Initiated and ongoing.	See the Biology and Management section.
Prioritize research needs and make data available to cooperators.	Initiated and ongoing.	See the Research Needs and Future Research and Management sections.

Recommendation	Action	Reference In This Document
Identify condor movement patterns and flight corridors.	Initiated and ongoing.	See the Biology and Management, Research Needs, and Future Research and Management sections.
Expose young birds to large carcasses as soon as possible.	Initiated and ongoing.	See Biology and Management section.
Manage and document condor nesting activities.	Ongoing.	See the Courtship and Reproduction section.

The California condor reintroduction program in the Southwest can highlight several significant accomplishments (which are described in detail throughout this report) of the second five-year period including:

- Addition of 5 wild-hatched chicks to the population, four of which are still alive.
- Implementation of a non-lead ammunition program in Arizona which has reduced available lead bullet fragments by an estimated 50% on the Kaibab and Paria plateaus.
- Reduction of overall mortality from almost 40% for the last reporting period to approximately 26% for this reporting period.
- Identification of lead ammunition residues as the primary obstacle to achieving the goal of a self-sustaining population.
- Improvement of adaptive management in the field to address behavior issues and increased coordination with California field teams.
- Virtual elimination of predation of newly released condors through improved field techniques.

The nonessential experimental rule provided direction to seriously consider terminating the program if condor mortality rates are at 40 percent or greater, or released condors are not finding food on their own. Please see the description of condor death and survival figures in the Demography Overview section. Although those rough figures do provide information regarding condor survival, the percentages should not be regarded as mortality rates. The figures do not allow for good inferences regarding population trend. For example, more useful estimates need to be life-stage-specific and should consider the number of days each condor was exposed to mortality as reported by Woods *et al.* (in press) for the period 1996-2004. TPF is currently assembling the recent data for a population trend model covering the second five-years, during which the condor population was more fully invested in wild foraging than in the earlier period and thus more reflective of the mortality regime experienced by a wild population. This five-year review discloses the causes and circumstances of condor deaths and the resulting management actions. This report clearly indicates that lead contamination is a major factor that may hinder the success of the program. If the program is to succeed in the establishment of a self-sufficient population of condors, the effects of lead contamination must be reduced or eliminated.

The SCWG believes the report indicates that the partners, participants, and agencies involved in the reintroduction effort continued to meet their obligations during the reporting period. The SCWG recommends to the California Condor Recovery Team and FWS continuation of the California condor reintroduction program in the Southwest.

The review team would again like to acknowledge the tremendous efforts of TPF, and especially their and other field personnel, in carrying out the reintroduction of condors in the Southwest. The participation of AGFD, UDWR, BLM, NPS, USFS, and FWS in the program has greatly contributed to its overall success. There has been an enthusiastic acceptance of the condor reintroduction program by the public, including in local communities, with support provided by local land owners and businesses.

Future Administrative and Field Operation Recommendations

Below is a summary list of recommendations made in several sections of this report. See Tables 8 and 9 for other ongoing efforts. Other topics and issues can be expected to arise in the next five-year period of the reintroduction program. As issues arise, appropriate discussion within the SCWG and implementation of necessary adjustments or modifications can be expected.

- Broaden outreach efforts to more effectively address ongoing issues with lead shot, bullets from varmint hunters, and non-participation in the free non-lead ammunition program. The effort will include additional outreach to Utah, hunting guides, Native American Nations, and others. The effort will include strategic use of media in outreach efforts.

- Expand the Condor Coalition by recruiting influential national and local sportsmen's groups.

- Continue publishing and sharing results from the free non-lead ammunition program with the public including results from the University of Arizona lead isotope study.

- Assess whether the voluntary lead-reduction efforts are effective in reducing the amount of lead available to condors.

- Consider monthly condor reports for distributing information to the North Rim, Kaibab Lodge, Jacob Lake visitor center, and other venues to assist with information demands of staff, interpreters, and visitors.

- Expand interpretative training for NPS to include staff on the North Rim.

- Consider a module on condors in the Focus Wild Arizona curriculum, perhaps with satellite telemetry data.
- Assist the southern Utah NPS units with development of outreach materials for visitors.
- Add WS in Arizona and Utah to the SCWG mailing list so they are invited to future meetings and receive updates.
- Clarify conservation measures for land-management practices.
- Continue the effort to expand the 10(j) area.

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Appendix A. Summary of public comments received during the second five-year review.

October 3, 2006, Public Open House in Kanab, Utah

1. Lead issues.
2. Contribution of this reintroduction effort to recovery of condor.
3. Other non-lead contaminant issues.
4. Other non-lead mortality factors.
5. West Nile virus.
6. Condors and recent fires.
7. Roosting and breeding locations.
8. Research on reintroduced population.
9. Resources expended on monitoring.
10. Improve the observation area.
11. Supply condor information to facilities /lodges in the area.

October 4, 2006, Public Open House in Flagstaff, Arizona

1. 10j rule and proposed expansion.
2. Lead issues.
3. Micro-trash issues.
4. Power pole aversion training.
5. Adaptive management; program an experiment or for success.
6. Current mortality rate and sustainable population.
7. Report breeding pair status for the five-year period.
8. Project 2007 breeding potential.
9. Status of Hurricane Cliffs release site.
10. Status of Baja California releases.
11. Why have some eggs failed.
12. Increase public education.

Comments received by mail or email.

1. Support expansion of 10j area; proceed quickly.
2. Support use of non-lead ammunition; continue program; educate hunters.
3. Support program; current collaboration allows for any necessary adjustments.
4. More education about condors needed for teachers and children.
5. All GRCA staff should use non-lead ammunition.
6. Condor location data are needed on north rim for daily ranger programs.
7. Request TPF representatives for next spring's interpretive training.
8. Endorsement of recommendations on page 49 of first five-year review.
9. In exchange for 10(j) area expansion, ask for funding of education and outreach programs and ask new states to implement a non-lead ammunition program.
10. Provide more information to locals such as Kaibab Lodge and Jacob Lake.
11. Evolving (increasing) participants is good; bring new partners up to speed.
12. Should be no restriction of land use, even voluntary.

13. Increase public education for awareness and to decrease impacts.
14. Continue to enlarge collaboration with other hunting/shooting stakeholders.
15. Continue and increase monitoring; continue lead testing and treatment program.
16. Site new powerlines and other development away from recovery areas.
17. Enforce meaningful consequences for human harassment and offer rewards.
18. Protect and maintain primitive nature of condor habitat.
19. Increase study of condor behavior, needs, and mortality factors; improve recovery and analysis of carcasses.

Issue	Response	Reference In This Document
Describe the source of lead contamination.		See the Health and Lead Reduction Efforts sections.
Describe the lead data collected on condors from the California population. Do condors in California face the same level/threat of lead exposure as Arizona birds? Can we learn any management lessons from comparing differences?	The California program and lead issues are largely outside the scope of this report. However, we continue to make efforts to address the lead contamination issue in our Southwest population. Meetings of the California and Arizona field staff are regularly conducted to share information regarding this and other items.	
Describe testing and treating (and the effects of treating) condors for lead contamination.		See the Biology and Management and Research Needs sections.

Issue	**Response**	**Reference In This Document**
Describe the response in dealing with lead-contaminated carcasses and exposure.	Telemetry data are evaluated daily and responded to immediately. Target birds are trapped, evaluated, and treated if necessary as soon as practical. Holding birds during the hunting season has been done in the past, and it continues to be evaluated, but is not considered a long-term solution. We do not have a supplemental feeding program. Food is provided at the release site to both facilitate recapture of birds for testing and treatment if needed and to aid in socialization of new birds. Data suggest that varying amounts of food at the release site during hunting season yields no observable changes in utilization.	See the Release Strategies section.
Where are lead-contaminated carcasses found?		See the Lead Reduction Efforts section.
Describe tests or investigation of other lead sources.		See the Lead Reduction Efforts section.
Describe the effects of lead on condors.	We do not know how quickly lead can result in condor mortality. Surrogate tests cannot be directly related to condors. Field data suggest that effects of lead are variable and probably influenced by a number of factors.	See the Health, Lead Reduction Efforts, and Research Needs sections.

Issue	**Response**	**Reference In This Document**
Provide free non-lead ammunition at Jacob Lake.	This idea has been evaluated but due to the wide variety of needed ammunition calibers it was determined to be impractical. Both mail order and store locations for securing ammunition are available.	
Can the lead-reduction program be extended to the State of Utah?	Lead poisoning was not identified as an issue specific to Utah during the review period. However, UDWR continues to evaluate the AGFD program and internal discussions concerning the lead-condor issue do occur. Funding is not currently available to implement a program of the scope of the AGFD program in Utah.	
Describe petitions to ban lead in condor areas in California (rationale and efforts to avoid similar complaints/processes in Arizona).	Petitions to ban lead in California are outside the scope of this report. This Southwest program has attempted to take a pro-active approach to reduce or eliminate lead on a voluntary basis.	See the Lead Reduction Effort section.
Use the effects of lead on human health to motivate hunters to use non-lead ammunition.	The SCWG believes we should continue to collect, analyze, and report data on the biology of condors. We do not have the expertise to address human health issues, and this information is available elsewhere.	
Highlight the lead-exposure issue in doves and other species.	Efforts are underway in this area in other forums such as the Association of Fish and Wildlife Agencies.	

Issue	Response	Reference In This Document
Can Barnes assist with funding the lead-reduction efforts in Arizona and Utah?	Additional funding sources are continuously being sought.	
Update USFS and BLM regulations to accommodate the burying of gut piles in the field.	Due to significant archeological issues in some areas, methods other than burying are encouraged so as to not disturb these important resources. Burying is generally not a viable option due to soil conditions and other factors (e.g. other predators regularly dig buried carcasses up and re-expose them to condors).	
Link the lead issue to a broader list of bird species such as the raven study in Wyoming and eagles.		See the Health and Lead Reduction Efforts sections.
AGFD should set up a disposal site for gut piles at check points (and/or Jacob Lake). Is there a tallow company that can assist with gut-pile collection sites?	These ideas will be considered for future years.	
Post a lead program educator at Jacob Lake (in addition to check stations).	Staffing will not allow this level of outreach. However, many other efforts are underway. The program attempts to respond to specific education needs and requests.	See the Lead Reduction Efforts section.
How does this reintroduction program contribute to the recovery goals for the California condor?		See the Recovery Goals section.
Are there any non-lead contaminant issues?	These are still being evaluated.	See the Research Needs section.

Issue	Response	Reference In This Document
Are there significant mortality factors other than lead? Except for lead, will the current rate of mortality allow for a sustainable population of condors?	Aside from lead, other mortality factors should allow for the possibility of a sustainable population.	See the Mortality and Demography Overview sections.
Is West Nile Virus in the wild or captive populations? What measures are taken to guard against West Nile Virus infection/mortality?		See the Health section.
Were any condors lost in recent fires?	No condors were lost due to the fires, and no significant changes in condor behavior were observed.	
Describe condor roosting, breeding, and locations.		See the Courtship and Reproduction section.
What (non-lead) research is being conducted on the reintroduced population?		See the Research Needs and Future Research and Management Needs sections.
How many hours and resources are expended monitoring the condors?	Eleven full-time biologists monitor the birds 365 days per year.	See the Program Costs section.
Improve the observation area at the release site. Visitors are sometimes frustrated when they don't see condors.	BLM is improving the facilities at the observation site. The various outreach efforts can help visitors plan their trips, but bird movements vary throughout the year and there is no guarantee that all visitors will observe condors.	
Supply condor information to the facilities/lodges in the area (Jacob Lake, Vermillion Cliffs Lodge, North Rim country). Reach out to give more information to local people.	Condor information is available at the Forest Service visitor center at Jacob Lake, at Navajo Bridge, at Lees Ferry Lodge, and at other locations. Material can be provided to other locations upon request.	

Issue	**Response**	**Reference In This Document**
What protections do condors receive in the 10(j) area? What condor management does the 10(j) area allow for? How does land and condor management differ on National Park Service land vs. BLM and Forest Service areas?		See the Compliance of Federal Agencies with Sections 7(a)(1), 7(a)(2), and 7(a)(4) of the Endangered Species Act section.
Do condors within the 10(j) area need to be considered under the National Environmental Policy Act?	Designation of the 10(j) area does not alter the responsibilities of land managers per other laws or regulations.	See the Compliance of Federal Agencies with Sections 7(a)(1), 7(a)(2), and 7(a)(4) of the Endangered Species Act section.
Who has requested expansion of the 10(j) area and why? 10(j) protection for all of Washington County and Utah doesn't seem to be moving very fast.		See the Expansion of the Nonessential Experimental 10(j) Population Area section.
What is the geographic "vision" for an expanded 10(j) area? Will additional or modified special rules be considered as part of a 10(j) expansion?	These questions will be evaluated and determined through the 10(j) expansion process.	See the Expansion of the Nonessential Experimental 10(j) Population Area section.
What are the effects to condor chicks and eggs of parental lead exposure and parental-delivered food contaminated with lead? What is the susceptibility of chicks to lead?	The susceptibility and effects are unknown. Attempting to determine them would require significant involvement with nesting and would be very difficult due to a number of factors. Necropsy results indicated condor chick 305 was in poor body condition and could have died from starvation; high lead levels were not detected during necropsy.	See the Health, Lead Reduction Efforts, and Research Needs sections.

Issue	**Response**	**Reference In This Document**
What studies have been conducted on lead-exposed birds' bone, muscle and features?	Research is underway as part of the California Condor Recovery Team efforts.	
Aside from expense, what deters hunters from using non-lead ammunition?		See the Lead Reduction Efforts section.
What are the differences between copper and lead fragmentation?		See the Lead Reduction Efforts section.
Can the California and Arizona programs learn anything from each other's experience in dealing with micro-trash?	To date, micro-trash has been observed but has not been a significant issue in the Southwest program. However, it is a significant problem in California, and the field crews from both programs continue to meet and share issues and concerns.	
Is mock power pole aversion training continuing, and does it continue to be effective?	The conditioning is conducted and it appears to be effective.	See the Release Strategies section.
Describe adaptive management as practiced in the condor reintroduction program. Is the program being conducted for science (an experiment) or for success?	This second-five year review illustrates the many ways that adaptive management occurs in the program. This condor population is designated a nonessential experimental population. However, the ultimate program goal is to establish a self-sufficient population of condors in the Southwest.	See the Recovery Goals section.
What is the projected 2007 (and subsequent years) breeding potential?	The known possibilities for 2007 include three pairs at the South Rim, one pair at Vermillion Cliffs, two pairs on Kaibab Plateau, and one pair in Utah.	

Issue	**Response**	**Reference In This Document**
Why did the team utilize the Hurricane Cliffs release site? What happened to it? Will it be used in the future?		See the Release Strategies section.
What is the status of the Baja Mexico releases?	The Baja effort is outside of the scope of this report. It currently consists of approximately 14-19 condors.	Please see the San Diego Zoo website for more information.
Why have some eggs failed?		See the Courtship and Reproduction section.
Can full-time interpretation be provided at El Tovar? Provide interpretation on the Grand Canyon Railway. Increase exposure in the schools. Is there an opportunity to incorporate condors in the Project Wild curriculum? More needs to be done in providing for education of teachers and children regarding condors.	GRCA conducts daily interpretation during the summer. Discussions are underway regarding interpretation on the Railway. We will continue to evaluate and respond to educational opportunities and requests. Specific requests should be submitted to the program.	See the Public Acceptance and Interest section.
Is the use of non-lead ammunition emphasized at Becoming an Outdoor Woman camps? Continue hunter education to use non-lead ammunition. Continue to enlarge collaboration with other hunting/shooting stakeholders. Continue to offer free non-toxic ammunition.	The program will follow up on the Becoming an Outdoor Woman question.	See Lead Reduction Efforts section.
All GRCA staff (rangers and interpretive staff) need to be aware of condors and use non-lead ammunition.	This report should provide a broad background for GRCA staff. Non-lead ammunition is available for all staff.	

Issue	Response	Reference In This Document
Condor location data are needed on the north rim of GRCA for daily ranger programs.	General information can be and is provided. Specific information will not be provided in order to protect the birds.	
TPF representatives should be available for next spring's interpretive training.	TPF staff are available and respond to as many training requests as possible.	
In exchange for 10(j) expansion, the program should ask for full funding of education and outreach programs. For example, new states in the expansion should be asked to implement a non-lead ammunition program.	These suggestions may be considered during the 10(j) expansion process.	
Increasing the number of participants is good. Program needs to work better to bring in new partners up to speed. Should be no restriction of land use, even voluntary. Proceed quickly with 10(j) expansion.		See the Coordination Among Program Cooperators, Compliance with Commitments, Expansion of the Nonessential Experimental 10(j) Population Area, and Compliance of Federal Agencies with Sections 7(a)(1), 7(a)(2), and 7(a)(4) of the Endangered Species Act sections.
Continue and increase monitoring. Improve recovery and analysis of carcasses. Continue lead testing and treatment program. Increase study of condor behavior, needs, and mortality factors.		See the Biology and Management and Lead Reduction Efforts sections.

Issue	Response	Reference In This Document
Site new powerlines and other development away from recovery areas. Protect and maintain primitive nature of condor habitat. Continue protection of habitat and management that maintains its primitive nature.	Although much of the condor range is primitive, condors do occur in less-than-primitive areas. A variety of human activity will continue to occur throughout the range of the condor. A variety of means are in place to protect condors and habitat.	See the Compliance of Federal Agencies with Sections 7(a)(1), 7(a)(2), and 7(a)(4) of the Endangered Species Act section.
Enforce meaningful consequences for human harassment and offer rewards.		See the Compliance of Federal Agencies with Sections 7(a)(1), 7(a)(2), and 7(a)(4) of the Endangered Species Act and Law Enforcement sections.

Appendix B. Abstracts cited in the Health, Demography Overview, and Lead Reduction-Efforts sections of this report.

1. Hunt, W. G, W. Burnham, C. N. Parish, K. Burnham, B. Mutch, and J. L. Oaks. 2006. Bullet fragments in deer remains: implications for lead exposure in scavengers. Wildlife Society Bulletin 34: 168-171.
Abstract: Bullet fragments in rifle-killed deer carrion have been implicated as agents of lead intoxication and death in bald eagles (*Haliaeetus leucocephalus*), golden eagles (*Aquila chrysaetos*), California condors (*Gymnogyps californianus*), and other avian scavengers. Deer offal piles are present and available to scavengers in the fall, and the degree of exposure depends upon the incidence, abundance, and distribution of fragments per offal pile and carcass lost to wounding. In radiographs of selected portions of the remains of 38 deer (*Odocoileus* spp.) supplied by cooperating, licensed hunters in 2002–2004, we found metal fragments broadly distributed along wound channels. Ninety-four percent of samples of deer killed with lead-based bullets contained fragments, and 90% of 20 offal piles showed fragments: 5 with 0–9 fragments, 5 with 10–100, 5 with 100–199, and 5 showing > 200 fragments. In contrast, we counted a total of only 6 fragments in 4 whole deer killed with copper expanding bullets. These findings suggest a high potential for scavenger exposure to lead.

2. Hunt, W. G., C. N. Parish, S. C. Farry, R. Sieg, and T. G. Lord. In Press. Movements of introduced California Condors in Arizona in relation to lead exposure. Pages xx-xx *in* California Condors in the 21st Century (A. Mee, L. S. Hall, and J. Grantham, Eds.). Special Publication of the American Ornithologists Union and Nuttall Ornithological Club.
Abstract: The California Condor restoration program in Arizona has benefited by the close monitoring of movements of condors with respect to food acquisition, mortality factors, and encounters with humans and artifacts. All 69 individuals released during 1996-2004 were equipped with VHF transmitters, and 18 carried PTT/GPS satellite-based transmitters for varying periods since fall 2003. Tracking data revealed an evolving cycle of annual movement. Condors generally remained near the release site during winter and then traveled in spring and summer to the Colorado River corridor and the Grand Canyon. Summer and fall use of the Kaibab Plateau increased each year, as did the contingent of birds summering in the Zion region of southern Utah. Movement was more expansive in winter 2004/2005 than in previous winters, in part reflective of an increasing number of pairs establishing breeding territories. We obtained circumstantial evidence of lead sources by examining itineraries of condors on a case-by-case basis during the weeks prior to lead testing. Information supporting the hypothesis of bullet fragments in hunter-killed deer carrion as the primary cause of elevated blood-lead levels in condors includes (1) a recent study showing that the remains of most rifle-killed deer contain numerous lead fragments, (2) observations of condors in association with deer remains (N = 78 cases); (3) an increase of lead blood-levels with increased use of deer-hunting areas of the Kaibab Plateau in 2002, (4) spikes in lead blood-levels and condor visitation to the Kaibab Plateau during and just after the 2002, 2003 and 2004 deer seasons, and (5) significantly higher lead levels among condors visiting the Kaibab Plateau in the weeks prior to testing.

3. Parish, C. N., W. R. Heinrich, and W. G. Hunt. In Press. Five years of lead exposure among California Condors released in Arizona. Pages xx-xx *in* California Condors in the 21st Century (A. Mee, L. S. Hall, and J. Grantham, Eds.). Special Publication of the American Ornithologists' Union and Nuttall Ornithological Club.
Abstract: Lead poisoning was the most frequently diagnosed cause of death among free-ranging California Condors released by The Peregrine Fund in Arizona during 1996–2005 and may have caused additional undiagnosed fatalities. Among 437 blood samples analyzed March 2000 through December 2004 (excluding retests of exposed individuals), at least 176 showed evidence of lead exposure (≥15 µg/dl); 82 of those were between 15.0 µg/dl and 29 µg/dl (exposed), 55 between 31.0 µg/dl and 59 µg/dl, and 39 exceeded 60 µg/dl (clinically affected). Laboratory tests showed that at least 25 of the latter group were above 100 µg/dl; 10 of those exceeded 200 µg/dl, and 5 showed greater than 400 µg/dl; Chelation therapy was administered in 66 cases. Radiographs of 7 condors (3 alive, 4 dead) revealed shotgun pellets in their stomachs, and 7 more (6 alive, 1 dead) showed ingested lead fragments consistent with those of spent rifle bullets. Psyllium fiber or surgery was used to purge lead from the stomachs of surviving individuals. These data indicate that condors in northern Arizona frequently ingest lead and that rifle- and shotgun-killed animals are an important source of toxic exposure.

4. Woods, C. P, W. R. Heinrich, S. C. Farry, C. N. Parish, S. A. H. Osborn, and T. J. Cade. In Press. Survival and reproduction of California Condors released in Arizona. Pages xx-xx *in* California Condors in the 21st Century (A. Mee, L. S. Hall, and J. Grantham, Eds.). Special Publication of the American Ornithologists' Union and Nuttall Ornithological Club.
Abstract: A drastic decline in California Condors resulted in their complete removal from the wild in the 1980s and subsequent establishment of captive populations to propagate offspring for reintroductions. In 1996 The Peregrine Fund began releasing captive-produced condors in the Grand Canyon region of northern Arizona. By July 2005, 50 juvenile and 27 subadult condors had been released, and the free-flying population presently includes 14 adults, which have laid 11 eggs, fledged 3 young, and currently have 2 nestlings. Of the 77 released birds, 26 (34%) have died. Eight condors perished in their first 90 days following release and 14 in their first year (annual survival of 80%). Survival increased to 90% in the second through fourth years, and 98% from the fifth year onward. Lead poisoning from ingested shotgun pellets and bullet fragments was the greatest cause of fatalities for birds after their first 90 days free-flying, with six birds known and two suspected to have died of lead toxicity. Many surviving condors were also treated with chelation therapy at least once to reduce high blood lead levels. Under a program of intensive management, survival rates have been in the range expected for wild condors and pairs are breeding successfully. Self-sustainability, however, will require that lead in the condors' food be greatly reduced or eliminated.

5. Sullivan, K., R. Sieg, C. Parish. In Press. Arizona's efforts to reduce lead exposure in California condors. Pages xx-xx *in* California Condors in the 21st Century (A. Mee, L. S. Hall, and J. Grantham, Eds.). Special Publication of the American Ornithologists' Union and Nuttall Ornithological Club.

Abstract: Exposure to lead is one factor affecting the success of the California condor (*Gymnogyps californianus*) reintroduction program in Arizona. There have been 176 documented cases of lead exposure and 66 chelation treatments administered since 1999. Six condor deaths have been attributed by necropsy to lead poisoning. To address this, the Arizona Game and Fish Department (AGFD) and its partners are working to reduce lead exposure due to spent lead ammunition found in animal carcasses and gut piles. We have focused on public education, scientific research, and voluntary use of non-lead ammunition. In 2003, 205 Arizona hunters were interviewed by phone. Only 23% of the hunters were aware that lead poisoning was a problem faced by condors, but 83-97% were willing to take some action to help condors if credible lead exposure data were made available. Focus groups then rated condor conservation and lead reduction messages. As a result, condor lead data and conservation messages have been provided to the public since 2003. The AGFD and The Peregrine Fund are also funding research to investigate the link between lead ammunition and condor lead exposure. Preliminary results confirm lead from ammunition is a major source of lead exposure in condors. Other efforts include the formation of a voluntary lead reduction coalition consisting of sportsmen's groups and government agencies. The AGFD also funded a pilot program for the fall 2005 hunting season, providing free non-lead ammunition to deer hunters within the condor range. We hope the combination of these efforts will decrease the number of condor lead exposures in the future.

Appendix C. Actions taken to reduce lead exposure in condors.

2002

- The AGFD met with TPF to discuss condor lead exposure problems in Arizona.

2003

- 3,700 fall big game tag holders mailed letters asking them to take lead reduction actions on their hunt within condor range.
- A full-page condor article with information on lead reduction published in AGFD hunting regulations.
- Hunters were interviewed regarding their knowledge of condors and lead issues at Jacob Lake check station.
- Lead reduction notices were posted for varmint hunters on the Kaibab Plateau.
- AGFD provided non-lead ammunition to law enforcement personnel within the condor range to dispatch injured animals.
- Lead mitigation Subcommittee of the Condor Recovery Team conducted surveys of hunters and ranchers in Utah, Arizona, and California.

2004

- 7,800 fall big game tag holders were mailed letters asking them to take lead reduction actions on their hunt within condor range.
- A full-page condor article with information on lead reduction was published in the AGFD hunting regulations.
- Information on non-lead ammunition was posted on the AGFD Web page.
- AGFD and TPF coordinated with NPS and local law enforcement agencies on an injured animal dispatching protocol.
- AGFD coordinated with the USFS Jacob Lake Visitor Center on a condor display that included a lead reduction message.
- Funds were transferred to TPF to purchase satellite transmitters for a condor movement lead exposure study.

2005

- First year of free non-lead ammo program was implemented. 2,400 fall big game tag holders were mailed coupons for free non-lead ammunition to use on their hunt within the core condor range.
- 4,800 fall and spring big game tag holders were mailed letters asking them to take lead reduction actions on their hunt within condor range.
- A full-page article with condor-lead data and lead reduction information was published in the AGFD hunting regulations.
- A condors and lead web page was added to the AGFD condor web page.
- The lead reduction message was added to every condor educational presentation.
- AGFD contracted the University of Arizona to conduct a lead isotope study.

- AGFD and TPF presented a lead reduction update at the Utah Wildlife Society meeting.
- Project cooperators met for "one voice" training on condor-lead issues
- A post-hunt survey was conducted to evaluate free non-lead ammo program.
- AGFD and TPF presented a lead reduction update at AOU Conference.
- Funds were transferred to TPF to purchase satellite transmitters, x-ray machine, medical/rehabilitation facility supplies, trailer and freezer for calf carcasses, optics, telemetry receivers, and data entry system.
- AGFD recruited three local sportsman's groups (Arizona Deer Association, Arizona Antelope Foundation, Arizona Desert Bighorn Sheep Society) to join the Condor Coalition and support lead reduction efforts in condor range.

<u>2006</u>

- Second year of free non-lead ammo program was implemented. Over 1,400 summer and fall big game tag holders in core condor range were eligible for the program. An additional hunt unit was added to the program. More loaded calibers and grain weights, bullets for hand-loaders, and muzzleloader ammunition were also added.
- 5,200 fall big game tag holders were mailed letters asking them to take lead reduction actions on their hunt within condor range.
- A full-page article with condor-lead data and lead reduction information was published in the AGFD hunting regulations.
- Condor-lead research and post-hunt survey results were added to the AGFD condors and lead web page.
- AGFD presented a lead reduction update at the Arizona Wildlife Society meeting and Arizona Colorado Plateau research meeting.
- AGFD and TPF trained GRCA interpretive staff for public dissemination of the lead reduction message.
- AGFD and TPF hosted a non-lead shooting booth with Federal Ammunition at the Department's shooting showcase.
- The Department persuaded two more local sportsman's groups (Arizona Elk Society, the Arizona chapter of the National Wild Turkey Federation) to join the Condor Coalition and support lead reduction efforts in condor range.
- AGFD and TPF assisted with and attended the first non-lead ammunition shooting showcase for the condor program in California.
- Posted flyers in public locations during the Kaibab Plateau deer seasons to raise awareness of the lead issue.

EXHIBIT 3

The Auk 127(4):969–1001, 2010
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Printed in USA.

STATUS OF THE CALIFORNIA CONDOR (*GYMNOGYPS CALIFORNIANUS*) AND EFFORTS TO ACHIEVE ITS RECOVERY

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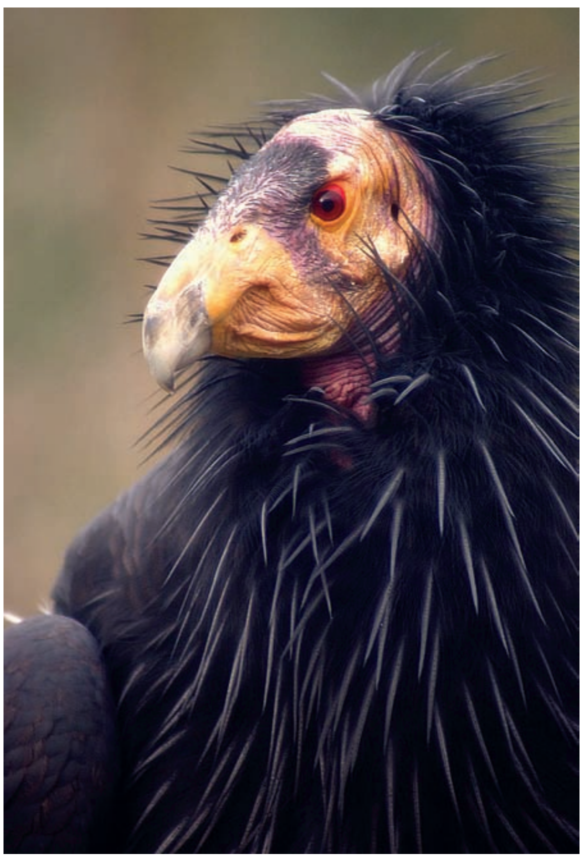

Fig. 1. Adult California Condor. (Photograph by S. Haig, U.S. Geological Survey.)

The California Condor (*Gymnogyps californianus*; hereafter "condor"; Fig. 1) has long been symbolic of avian conservation in the United States. Its large size, inquisitiveness, and association with remote places make it highly charismatic, and its decline to the brink of extinction aroused a continuing public interest in its plight. By 1982, only 22 individuals remained of this species whose range once encompassed much of North America. The last wild bird was trapped and brought into captivity in 1987, which rendered the species extinct in the wild (Snyder and Snyder 1989). In the 1980s, some questioned whether viable populations could ever again exist in the natural environment, and whether limited conservation funds should be expended on what they viewed as a hopeless cause (Pitelka 1981). Nevertheless, since that low point, a captive-breeding and release program has increased the total population by an order of magnitude, and condors fly free again in California, Arizona, Utah, and Baja California, Mexico (Fig. 2). At this writing (summer 2009), more than 350 condors exist, 180 of which are in the wild (J. Grantham pers. comm.). The free-living birds face severe challenges, however, and receive constant human assistance. The intensive management applied to the free-living populations, as well as the ongoing monitoring and captive-breeding programs, are tremendously expensive and become more so as the population grows. Thus, the program has reached a crossroads, caught between the financial and logistical pressures required to maintain an increasing number of condors in the wild and the environmental problems that preclude establishment of naturally sustainable, free-ranging populations.

Recognizing this dilemma, in November 2006, Audubon California requested that the American Ornithologists' Union (AOU) convene an independent panel to evaluate the California Condor Recovery Program. The National Audubon Society (NAS) and the AOU have a long history of interest and involvement in condor

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Fig. 2. Free-flying California Condor in southern California. (Photograph by A. Fuentes, courtesy of U.S. Fish and Wildlife Service.)

recovery. The NAS helped fund Carl Koford's pioneering studies of condor biology in the 1940s (Koford 1953). A previous panel jointly appointed by the NAS and AOU examined the plight of the condor in the late 1970s, and their report (Ricklefs 1978) laid the groundwork for the current conservation program. The NAS was a full partner with the U.S. Fish and Wildlife Service (USFWS) in the early days of the program, from 1980 through 1988. Ricklefs (1978) recommended that the program "be reviewed periodically by an impartial panel of scientists," and this was done annually by an AOU committee for several years after the release of the report, but the condor program has not been formally and thoroughly reviewed since the mid-1980s. Audubon California believed that the recovery program was operating with a recovery plan (USFWS 1996) widely acknowledged to be outdated, and that issues that were impeding progress toward recovery needed outside evaluation in order for the USFWS, which administers the program, and other policy makers to make the best decisions about the direction of the program (G. Chisholm pers. comm.). Such an evaluation would also help funding organizations better invest in the program.

This review falls within the charge of the AOU Committee on Conservation, which is to evaluate science relevant to avian conservation. The AOU therefore agreed to establish a Blue Ribbon Panel (the authors) as a subcommittee of the Committee on Conservation. Audubon California obtained funding from the National Fish and Wildlife Foundation, the Morgan Family Foundation, and other private donors to support the work of the panel. Our charge was to evaluate and synthesize the accumulated knowledge and experience in order to reassess the recovery program's fundamental goals and recommend needed changes. Specifically, we were charged with the following tasks:

- To collect, review, and synthesize knowledge and experience about condor reproduction, rearing, foraging, mortality, and other aspects of the species' life history and ecology with the goal of characterizing the relative degrees of consensus and uncertainty about each;
- To assess and prioritize the relative importance of physiological, behavioral, and ecological factors in terms of their potential to limit the species' recovery and sustainability;
- To recommend scientific research, including controlled field experiments and population dynamics modeling, needed to resolve or bound remaining key uncertainties about factors affecting the condor's recovery;
- To review key operational aspects of the recovery program and recommend changes needed to improve the effectiveness, value, quality, and validity of the practices employed and the data generated by research and monitoring;
- To assess the organizational and funding structure and the management function of the recovery program and the California Condor Recovery Team, and to recommend changes needed to improve the program's overall effectiveness and value; and
- On the basis of all of the above, to reassess the program's fundamental goals and recommend needed changes.

To fulfill this charge, we reviewed the condor recovery program from September 2007 through July 2008 by visiting captive-breeding facilities in Los Angeles, San Diego, Boise, and Portland; visiting release sites in southern California, central California, and Arizona; reading the published literature and unpublished reports; conducting interviews with program participants in person during site visits and via telephone conference calls; and soliciting written comments from those with whom we were unable to speak personally. Our findings are based on the available science, and in many instances the science is sufficient to support strong inferences. Where the science is sparse or equivocal, we offer consensus opinions based on the available facts and experiences of those in the condor program. In developing these opinions, we relied especially on the collective knowledge of those who work directly with the birds in the field and in captivity.

We presented our findings, conclusions, and recommendations in a report released at the AOU meeting in Portland in August 2008. That report served as the foundation for the present publication, augmented by comments, suggestions, and further information provided by individuals within and outside of the condor program in response to the report. The following is not a thorough review of the literature on condors, but rather an assessment of the current state of the species and its recovery program. Accordingly, we rely heavily on recent publications that summarize the literature, especially the volume that resulted from the 2005 AOU symposium on condors (Mee and Hall 2007). We hope that we have provided a new vision of the program for the next 10–25 years, as the previous AOU report (Ricklefs 1978) did for the past 30 years.

Condor Biology

The condor is by far the largest soaring bird in North America, with a wingspan of 2.8 m and body weight of 8.5 kg (Snyder and Schmitt 2002). The species had a wide distribution in North America before the late Pleistocene megafaunal extinctions

(Emslie 1987), but by the 19th century it was largely restricted to the West Coast, from British Columbia to Baja California. By the middle of the 20th century, the species was confined to southern California (Koford 1953, Wilbur 1978). In modern times, condors inhabited a variety of western landscapes from coasts to deserts to high mountain ranges that included beaches, shrublands, and forests. Modern records of nest sites of wild condors are all from California and include rugged cliffs and ancient trees.

Condors feed exclusively on carrion, primarily medium- to large-sized mammal carcasses. Prehistoric condors evidently fed on carcasses of (now extinct) megafaunal species and marine mammals, and the diet of modern condors includes domestic livestock as well as native terrestrial and marine species (Chamberlain et al. 2005). Condors use their exceptional soaring abilities to cover large distances in search of food. Meretsky and Snyder (1992) reported nesting birds traveling up to 180 km from the nest in a single trip in search of food, and foraging ranges of nonbreeding birds of 7,000 km^2. Condors are highly gregarious in feeding and most other activities, with the exception of nesting, which occurs in caves in cliffs or natural cavities on nesting territories defended by pairs (Snyder and Schmitt 2002). Theirs is a textbook example of a long-lived life history (Mertz 1971), characterized by high survival rates and exceedingly low reproductive rates, with breeding pairs producing, if all goes well, two fledglings in a 3-year period (Meretsky et al. 2000). For further details of condor biology, see Koford (1953), Wilbur (1978), Snyder and Snyder (2000), and Snyder and Schmitt (2002).

History of the Condor Recovery Program

Condors were first protected nationally in 1967 under the auspices of the U.S. Endangered Species Preservation Act, and the birds were formally listed and protected as endangered with the signing of the U.S. Endangered Species Act (ESA) in 1972. The California Condor Recovery Team was formed in 1973, and it produced the first recovery plan for an endangered species in the United States in 1975 (USFWS 1975). The program initially followed a noninterventionist course, but given the continuing decline of the wild population, a pessimistic assessment by Verner (1978), and their own analysis, the AOU–NAS panel recommended an immediate intensive research program that included captive breeding, radiotelemetry, and field investigations of the causes of the species' decline (Ricklefs 1978). This highly publicized and, to some, highly controversial program was initiated in 1980 by a joint partnership between the USFWS and NAS. The species continued to decline over the next 6 years despite intensive field work, and by 1986, with only three birds remaining in the wild, the decision was made (following the recommendation of the Recovery Team) to bring the last birds into captivity (Fig. 3). By that time, eggs, chicks, and unmated adults had been removed from the wild to begin a captive-breeding program.

The condors were initially housed at the Los Angeles Zoo and San Diego Wild Animal Park. In 1993, The Peregrine Fund joined the effort as an additional partner and began breeding birds at their Boise, Idaho, facility (Fig. 3). Successful reproduction in captivity was first achieved in San Diego in 1988 (by two wild-trapped

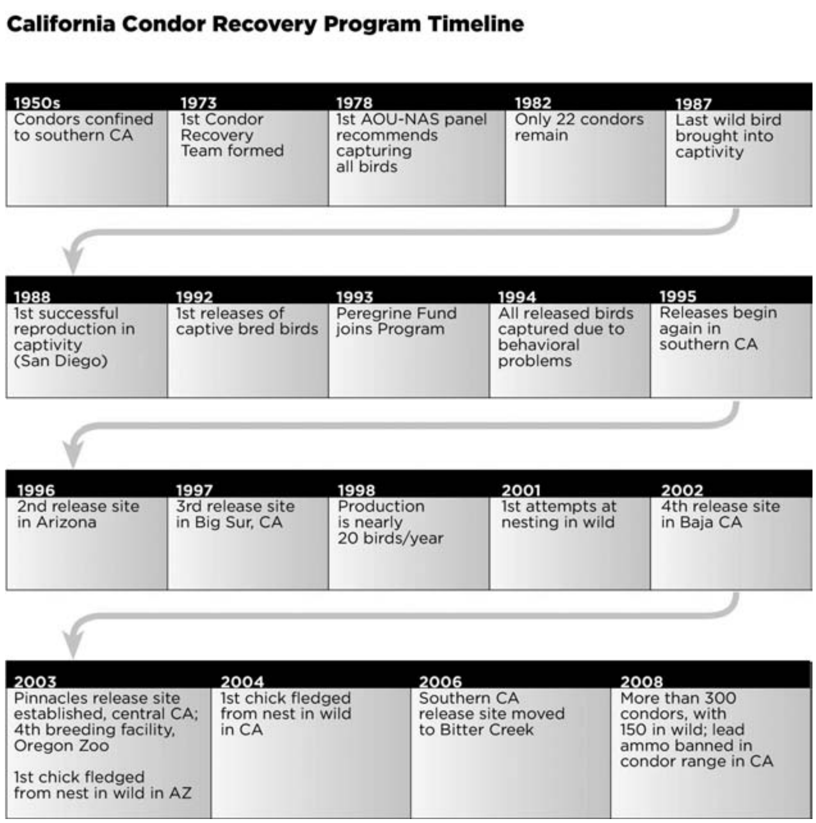

Fig. 3. California Condor Recovery Program timeline.

adults), and by the late 1990s, the program was producing 20 offspring per year and all of the birds originally removed from the wild were breeding successfully in captivity (Snyder and Schmitt 2002). The Oregon Zoo in Portland was added as a fourth captive-breeding facility in 2003.

The first releases of captive-reared birds occurred in 1992 in southern California, but recurring issues with the birds' attraction to human-built structures led to a decision to return the initial cohort of released condors to captivity in 1994. Releases were reinitiated in southern California in 1995 and have continued since. A second release site was established in Arizona in 1996, and a third in central California in the Big Sur area in 1997 (Fig. 3). In 2002, a fourth release site was added in Baja California, Mexico, and the following year marked the debut of Pinnacles National Monument as a second location from which to release birds in central California. Reintroduced birds first attempted to nest in southern California and Arizona in 2001. The first fledging of a chick by reintroduced birds occurred in Arizona in 2003 (Woods et al. 2007), followed by the first successful fledging in California the next year (Grantham 2007).

THE CONDOR PROGRAM TODAY

The condor recovery program has achieved success beyond what many believed possible when the last few birds were brought into captivity. Numbers have increased steadily (Fig. 4). Managers are routinely releasing birds raised in captivity that exhibit desirable and socially appropriate behavior in the wild, and further additions to the free-living population come from chicks fledged from natural nests by breeding pairs that formed on their own after release. In Arizona, birds subsist on food they find themselves for much of the year, and in central California they feed on carcasses of marine mammals, including several whales that have washed ashore. Millions of hectares of nesting and foraging habitat for condors are protected to some degree. A large number of highly committed partners contribute substantially to the program, and new partners continue to join the effort. Recovery of the condor, once almost inconceivable, has become imaginable, and the public believes the condor program to be a success.

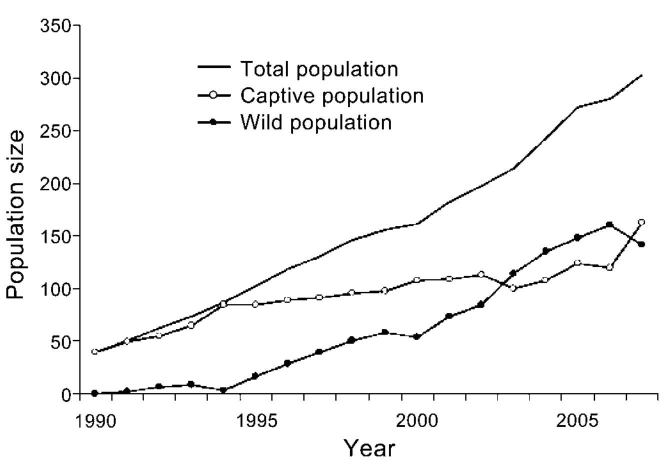

FIG. 4. Population size over time for the captive, free-living, and total populations of California Condors (from Wallace et al. 2007a).

Yet enormous obstacles to recovery still exist, so much so that the possibility that condors could once again be extirpated in the wild is as conceivable as recovery. In our opinion, the free-living populations would disappear were the current enormous investment in intense monitoring and management of adults and subadults—and, at some locations, nestlings—to cease. Lead poisoning from ingestion of ammunition fragments in carcasses is so severe and chronic a problem at all release sites (Cade 2007) that the program partners are unified in the belief that condor recovery cannot be achieved so long as such lead exposure continues. Although relatively few birds have actually died from lead poisoning, deaths almost certainly would occur were the birds not regularly trapped, tested, and treated for lead. Several individuals have been treated for lead exposure multiple times. The free-living birds are induced to depend on carcasses provided by humans at feeding stations so that they can easily be trapped and treated for lead poisoning, and to reduce the ingestion of lead that occurs when they forage on their own. This likely detracts from their development of foraging skills. Feeding, trapping, and chelation treatment reduce deaths from ingestion of lead, but the effects of repeated, sublethal exposure to lead are as yet unknown. Effects on behavior and demography are likely, given the current levels of exposure (Pokras and Kneeland 2009).

Similarly, nesting success in southern California was negligible until intensive management of nests was instituted in 2007. It is likely that fledging success would be reduced to near zero again if chicks were not examined monthly for ingestion of microtrash (i.e., small bits of refuse of human origin, including items such as rags, nuts, bolts, washers, plastic, bottle caps, chunks of pipe, spent cartridges, and pieces of copper wire; see Mee et al. 2007a) and treated on site by veterinarians and field biologists. Chicks are also vaccinated for West Nile virus. Condors are maintained in the wild only with great effort and, hence, are the epitome of a conservation-reliant species (Scott et al. 2005). Partners cannot be expected to expend funds indefinitely to maintain condors in nature, especially when additions to the free-living population increase management requirements and annual costs. Population growth is limited not by capacity to produce captive-bred birds suitable for release, but by the willingness of partners to spend more money to keep more birds alive in the wild. The program is indeed at a crossroads, its success on its current path limited by tradeoffs among demography, management intensity, and population size.

Program Partners

The California Condor Recovery Program is one of America's oldest and most complex efforts to recover an endangered species. The large and physiographically imposing geographic range of the species, the need for captive-rearing, release, and monitoring expertise, and the uncertain response of free-ranging condors to known and yet-to-be-discovered limiting factors have spawned a complex mix of nongovernmental and international, federal, and state governmental organizations cooperating to restore the species at four release sites in two countries (Table 1).

The birds are managed to meet demographic and genetic objectives following a Species Survival Plan under the auspices of the American Zoo and Aquarium Association (e.g., M. P. Wallace et al. unpubl. report). Managed as a single population, the birds

Table 1. Annual financial contributions to the California Condor Recovery Program by major partners in 2007. Budget figures were provided by each partner. Participants maintain captive-rearing facilities, release sites, or both.

Partner	Annual expenditure	Rearing facility	Release site
U.S. Fish and Wildlife Service	$857,000[a]	No	Bitter Creek, Hopper Mountain
Los Angeles Zoo	$573,000	Yes	None
San Diego Wild Animal Park	$1,479,000	Yes	Baja
The Peregrine Fund	$1,520,000[b]	Yes	Arizona
Ventana Wildlife Society	$244,000	No	Big Sur
Pinnacles National Monument (National Park Service)	$500,000	No	Pinnacles
Oregon Zoo	$172,000	Yes	None

[a]Includes $186,000 for refuge operations.
[b]Includes $394,000 in earmarked funds through USFWS.

are exchanged between breeding facilities such that a bird raised at any captive-breeding facility might be released at any release site. Still, individual breeding facilities are associated with particular release sites because of geographic and programmatic linkages. In southern California, the USFWS operates release sites at Hopper Mountain and Bitter Creek National Wildlife Refuges, and these sites are linked with the captive-breeding operation at the Los Angeles Zoo. Veterinary staff and keepers from the Los Angeles Zoo provide field support at the southern and central California release sites, and birds from these release sites in need of medical attention are brought to the zoo for treatment. The captive-breeding program at the San Diego Wild Animal Park also has strong linkages with the southern and central California release sites, and in addition operates the Baja California release site in collaboration with the Instituto Nacional de Ecología in Mexico. The Mexican National Zoo currently has two condors on display and is a likely location for an additional captive-breeding program to be associated with this release site in the future. The Peregrine Fund links the captive-breeding facility in Boise with the Arizona release site, as it operates both. The Oregon Zoo provides birds to multiple release sites. In central California there is a strong relationship between two partners, the Ventana Wildlife Society and the National Park Service, which run the release sites in Big Sur and Pinnacles National Monument, respectively. The birds released at these two sites function as a single flock, and accordingly these two partners have integrated their monitoring and field-support activities.

This recovery effort is costly. Pitelka's (1982) projections have proved accurate: tens of millions of dollars have been spent on condor recovery over the past two to three decades. Currently, over $5 million is spent per year, and one of the key features of the condor program is the large proportion of this funding contributed by private partners. The Los Angeles Zoo funds their captive-breeding program and provides field support at the southern California release sites, expending $575,000 annually (Table 1). The San Diego Wild Animal Park expends $1.5 million annually on their contributions to the condor program. The USFWS provides The Peregrine Fund with congressionally earmarked funds ($394,000 in 2007 and $633,000 in 2008; we follow the U.S. Office of Management and Budget's definition of earmarks as appropriated funds, including add-ons, that specify location or recipient of funds) to operate the Boise captive-breeding facility and Arizona release site, and The Peregrine Fund contributes another $1.1 million of their own funds annually toward these operations. The Ventana Wildlife Society raises $250,000 annually from nongovernment sources for its operations in central California, and the National Park Service recently received a $500,000 increase in their permanent base funding that represents their contribution to the condor program. The Oregon Zoo currently spends $175,000 annually on their captive-breeding program, and their contribution will no doubt grow if establishing a new release site in the Pacific Northwest becomes a possibility (see below). The USFWS expends $850,000 annually in directing the program and operating the southern California release sites. The relatively modest funding that the USFWS has devoted to condor recovery compared with that from private partners (Restani and Marzluff 2001) likely reflects a general lack of political will to fund conservation (Miller et al. 2002, Restani and Marzluff 2002a), competition for scarce dollars throughout the Endangered Species Program and Refuge System, overregulation of USFWS budgets through the earmarking process (U.S. General Accounting Office 1988), and the necessity to commit scarce funds and personnel to respond to litigation (Restani and Marzluff 2002b).

Several other partners besides those involved in running the captive-breeding programs and release sites mentioned above make important contributions to the condor program. Personnel from the San Diego Zoo make major contributions to the program. The Santa Barbara Zoo is a new partner with a focus on outreach and studies of breeding ecology of wild birds in southern California and also helps with nest monitoring. Also in California, a lead awareness campaign is underway in the central and southern parts of the state under the auspices of the Institute for Wildlife Studies. The Arizona Game and Fish Department is an active partner in the condor program, contributing a full-time condor biologist whose primary responsibility is outreach. Birds released in Arizona range into Utah, and the Utah Division of Wildlife Resources has become involved in the consortium of partners concerned with that population (known as the California Condor Southwest Working Group). The California Department of Fish and Game has had relatively little involvement in the condor program, but that is changing with the advent of new state regulations to protect condors (see below). The agency plans to add a full-time condor biologist to their staff (D. Steele pers. comm.). The Oregon Department of Fish and Wildlife has recently become involved with investigating the potential for a release site in the Pacific Northwest (D. Shepherdson pers. comm.).

The business community has cooperated in the recovery effort. A private ranch in Baja California contributes to operations at the release site there. In southern California, the Tejon Ranch recently signed an agreement with several conservation organizations to set aside nearly 100,000 ha of habitat for condors. At Big Sur, Pacific Gas and Electric has spent hundreds of thousands of dollars, and may end up spending millions, to reduce condor deaths caused by collisions with power lines in this region (M. Best pers. comm.).

Currently, the contributions to condor recovery of federal agencies, other than the USFWS, that operate in the range of the free-living birds are relatively small. The Bureau of Land Management (BLM) provides a feeding site near Pinnacles National Park, has provided funds for monitoring equipment, and is funding trash removal in specific areas. The BLM and the U.S. Forest Service (USFS) manage important condor habitat, and some of their lands in Arizona and California are extensively used by condors. Future recovery efforts could benefit from more formal involvement by, and contributions from, these agencies.

Protection of habitat for nesting and foraging is a critical aspect of the condor program, and achievements in this aspect have been considerable. Most of the current condor nesting range is on public land, and in Arizona much of the foraging range is as well (Hunt et al. 2007). Some historical foraging habitat in southern California is no longer suitable, but historical grassland foraging habitat around the base of the San Joaquin Valley remains viable, and large swaths have been protected since about 1984, including the Bitter Creek National Wildlife Refuge (NWR) (5,867 ha), the private Wind Wolves Preserve (39,000 ha), and the Carrizo Plains National Monument (121,405 ha). The Tejon Ranch conservation agreement protects large swaths of foraging and roosting habitat in an area that is a critical gateway to historical foraging areas in the Sierra Nevadas (Wilbur 1978). Grassland and oak savanna remain critical foraging habitat for condors, as relatively little foraging takes place in densely forested or chaparral habitat.

Biological Issues and State of the Relevant Science

The biological challenges of establishing viable populations of a large, wide-ranging species with a low population growth rate are daunting, and there are serious obstacles to achieving that objective for condors. Below, we evaluate the major biological issues, the solutions to which lie in existing science and in research yet to be conducted.

Lead Exposure

Any discussion of the biological challenges confronting the condor program must begin with the issue of lead. A basic tenet of conservation biology is that reintroductions will inevitably fail if the factors that caused the species to decline in the first place have not been addressed (Meretsky et al. 2000). Reintroduction of condors may illustrate this principle, lead exposure being the recurring factor. Habitat loss and direct persecution through shooting and poisoning of carcasses were certainly involved in the decline of the condor through the 19th and into the 20th century (Snyder 2007), but there is compelling evidence that elevated mortality attributable to lead poisoning was a major cause of continuing decline at the time the birds were brought into captivity (Meretsky et al. 2000, Snyder 2007). Although the significance and source of lead exposure in reintroduced condors were debated just a few years ago (Beissinger 2002, Risebrough 2002), there is now widespread consensus and considerable evidence that poisoning from ingestion of lead ammunition fragments in carcasses currently precludes the establishment of viable populations in the wild (Cade 2007, Watson et al. 2009).

The condor is a long-lived species with a low reproductive rate (Mertz 1971), such that adult mortality rates certainly must be <10% (Meretsky et al. 2000), and likely <5% (Cade et al. 2004, Cade 2007, Woods et al. 2007), for populations to be self-sustaining. We conclude that condors are exposed to lead through ingestion of ammunition fragments frequently enough that, were the birds not treated, mortality rates would rise above those required for sustainability (see also Woods et al. 2007). There is risk of lead exposure from virtually every type of carcass on which condors feed: big game, small mammals, coyotes, domestic livestock, feral hogs, even (albeit rarely) marine mammals—all are sometimes shot with lead ammunition. Alternative views about the threat posed by lead and sources of lead exposure, which were plausible only a few years ago, are no longer credible (Newton 2009).

Reintroductions that have limited success because of failure to remove limiting factors can still be informative. Such is the case for condors. Although there has been some awareness that predatory and scavenging birds could be poisoned by lead in their food (Fisher et al. 2006), the plight of the condors has brought attention to the lead issue, resulting in a much better understanding of the dynamics of lead exposure, the pervasiveness of the problem, and the actions required to solve it. The lead ammunition issue goes well beyond condors, affecting other terrestrial scavengers and potentially even human health (Fisher et al. 2006, Watson et al. 2009; see below). Thus, condors have functioned as sentinels of an environmental problem that has yet to be adequately addressed in the western ecosystems they inhabit.

Some condors have died from lead poisoning. The first condor mortalities definitively linked to lead were in the 1980s (Janssen et al. 1986, Wiemeyer et al. 1988b). Among birds released since the mid-1990s, Fry and Maurer (2003), Woods et al. (2007), and Parish et al. (2007) documented six known and two suspected lead deaths in Arizona, and Dr. Cynthia Stringfield (2007, unpublished report to California Condor Recovery Team) documented 12 suspected cases of lead-caused mortalities in California (see also Hall et al. 2007). Unpublished information suggests that mortalities from lead exposure have occurred at all release sites, including three deaths (one confirmed to have been caused by lead, two suspected) in Baja California. Of course, not all of the 97 captive-reared condors that have died across all release programs since releases began in 1992 (J. Grantham pers. comm.) have been analyzed for lead exposure. In our opinion, trying to determine the exact number of condors that have died from lead poisoning is a fruitless exercise, because whatever this number is, it will be small in relation to the number of deaths that would have occurred were the birds not monitored intensively for exposure to lead and provided with clean carcasses to reduce exposure.

The frequency with which the field crews detect high, often debilitating and potentially lethal levels in the blood of free-living condors is alarming. For example, Parrish et al. (2007) detected such levels in 9% of 437 blood samples taken in Arizona during 2000–2004, and 40% of the samples indicated some degree of exposure to lead. In southern California, 8% of 214 blood samples taken during 1997–2004 indicated clinical exposure to lead, and 32% of 44 individual condors tested experienced at least one such exposure during the study period (Hall et al. 2007). The majority of the birds with clinical levels of lead exposure are treated successfully and returned to the wild. It is because of these many instances in which, without human intervention, condors likely would have died that we conclude, as have others (Cade 2007, Mee and Snyder 2007, Woods et al. 2007, Green et al. 2008, Newton 2009), that condor populations would not be stable in the absence of intensive management, and instead would decline to extirpation, as the original wild populations did.

Besides the potential for ingesting lethal doses of lead, condors may also suffer from repeated exposure to sublethal doses (Pokras and Kneeland 2009). Chronic exposure resulting in blood lead levels <10 μg dL^{-1} has been shown to cause subtle but permanent adverse neurological effects in human children (Canfield et al. 2003, Hunt et al. 2009), and it is probable that repeated exposures of condors at similar levels will also cause neurological impairment. In California, 82% of 469 condors tested had blood lead levels >10 μg dL^{-1} (data supplied by USFWS and Ventana Wildlife Society). In Arizona, 40% of 437 condors tested had levels >15 μg dL^{-1} (Parish et al. 2007). No formal behavioral evaluation has been conducted with lead-exposed condors to determine whether sublethal effects can be detected in exposed birds.

Exposure to lead in the field.—The working assumption of those in the condor program is that condors are exposed to lead through feeding on carcasses or gut piles of animals shot with lead bullets or shotgun ammunition (Mee and Hall 2007, Watson et al. 2009). Sources of exposure may include not only game species, but also varmints (e.g., ground squirrels, coyotes, and prairie dogs) and even livestock killed with lead bullets (R. Jurek pers. comm.). Whatever the species, one carcass can contain enough lead to kill many condors via the "snowstorm" effect (Fig. 5), when lead rifle bullets shatter into hundreds of fragments as they enter an animal (Hunt et al. 2006). Fry and Maurer (2003) estimated the lethal dose of lead to a condor to be 33–65 mg, approximately 0.3–0.6% of the mass of a 9,700-mg rifle bullet (150 grains). When a rifle bullet fragments into a lead snowstorm, there may be more than 200 fragments of this size produced that remain within the carcass or viscera left in the field (Hunt et al. 2006).

Bird species other than condors, especially Common Ravens (*Corvus corax*), Turkey Vultures (*Cathartes aura*), and Golden Eagles (*Aquila chrysaetos*), have been used to document the pattern of lead exposure in the environment. The surveillance studies of Wiemeyer et al. (1986) and Pattee et al. (1990) documented lead exposures in several species of avian and mammalian scavengers within the condor range in California. A similar study by Craighead and Bedrosian (2008) documented exposure in Common Ravens in Wyoming that fed on offal left in the field by elk hunters; blood measurements showed significant exposure in these birds, highly correlated with the fall elk-hunting season. The California Fish and Game Commission contracted a study in December 2007 with the University of California at Davis Wildlife Health Center to document the extent of lead exposure in avian and mammalian

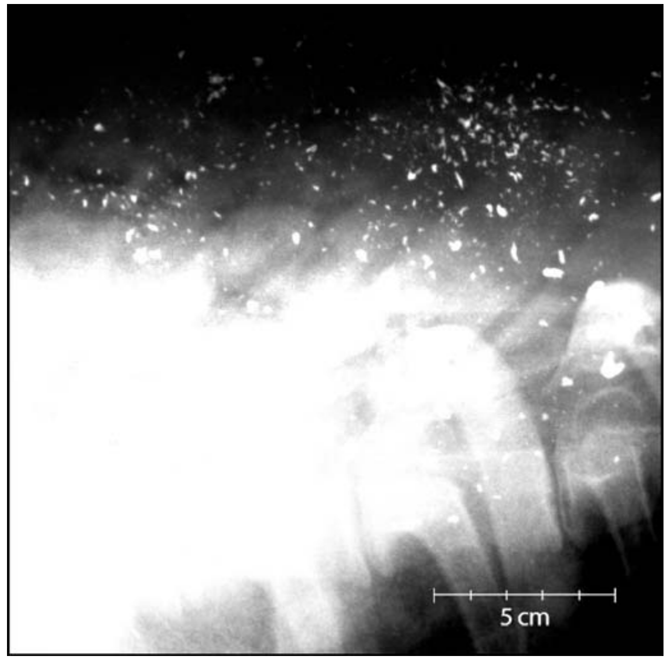

Fig. 5. Radiograph of lead fragment "snowstorm" in a deer carcass. (Photograph courtesy of The Peregrine Fund.)

scavengers within condor range and in other selected regions of California to determine whether the lead exposure problem is widespread. Results of this study are due in 2011.

Lead is monitored in condors in the field and confirmed with duplicate samples submitted to clinical reference labs in California and Arizona. Field blood testing of all condors occurs at least once a year, but generally more often. Field monitoring is done with portable LeadCare machines (ESA, Chelmsford, Massachusetts), which produce rapid readouts of blood lead levels, with a detection range of 3–65 μg dL^{-1}. Correlations between LeadCare data and data from clinical laboratories indicate that the field tests underestimate the actual blood lead levels by about 20–30% (Fry and Maurer 2003, Parish et al. 2007, Sorenson and Burnett 2007). Field crews in Arizona have access to a portable X-ray machine, which enables them to radiograph condors suspected of ingesting lead. Lack of such equipment hinders the ability to diagnose lead exposure at other field sites.

Identification of the sources of lead that are affecting condors is being undertaken by Donald Smith and his students at the University of California at Santa Cruz and by John Chesley at the University of Arizona. Both laboratories are using mass spectrometry to separate and quantify the natural isotopes of lead, which are found in varying proportions in metallic lead from mines throughout the world (Church et al. 2006, Chesley et al. 2009). There are four natural isotopes of lead (atomic weights: 204, 206, 207, and 208), each composing 1% to 56% of metallic lead. Lead from a single source often has a distinctive isotope pattern, and lead from different geographic regions is usually distinctive. Metallic lead objects made from a single source can frequently be identified, whereas lead from recycled sources, such as batteries or electronic parts, has less distinctive patterns that reflect mixing of different sources.

When a condor ingests lead, the metal is slowly dissolved by stomach acid, enters the blood stream, and is distributed to other tissues, including liver, muscle, kidney, brain, bone, and growing feathers. The isotope pattern of the lead in these tissues reflects the isotope pattern of the lead in the ingested lead object or lead-contaminated food. In an effort to identify sources of lead exposure in condors, the laboratories have been characterizing the lead isotope patterns in blood and feather samples and comparing them to ingested fragments of lead, commercial lead bullets, environmental lead background sources, and published data listing known lead-source isotope patterns.

The lead isotope patterns in blood or feathers have matched lead bullet fragments recovered from carcasses on which the birds were feeding (Church et al. 2006), and isotopes in blood and feathers match lead isotopes of fragments recovered from the gastrointestinal tracts of exposed birds (Chesley et al. 2009, Parmentier et al. 2009). These data implicate ammunition as a significant source of lead, but the data are far from complete, and the isotopic composition of some blood samples does not match the isotope patterns of the few ammunition samples that have been analyzed by Church et al. (2006) or reported in the literature. However, Chesley et al. (2009) recently provided convincing evidence that lead fragments in carcasses and gut piles match the isotope patterns found in condors feeding on that carrion. The scientists doing the identification have gone to great lengths to document exposures and match them to sources, and the data are convincing. Nonetheless, many individuals criticized the data at public hearings in California on the grounds that all potential sources of lead in the condor range have not been characterized. These critics argued that other materials besides ammunition fragments, including microtrash, may be significant sources of lead. We agree that there are many potential sources of lead in western ecosystems but are convinced that ammunition fragments are the major source of lead exposure for condors in the wild.

Determining baseline lead levels.—To assess lead exposure, one must know the baseline level of lead concentration in the blood. A background or baseline level of 20 μg dL^{-1} lead in blood of wild scavengers was proposed by Redig (1984) on the basis of an analysis of Bald Eagles (*Haliaeetus leucocephalus*) and other raptors (Redig et al. 1980). Many authors have used this figure since (Wiemeyer et al. 1986, Patee et al. 1990, Fry and Maurer 2003). However, this baseline appears to be unrealistically high and reflective of lead contamination from ammunition fragments and other sources, including environmental contamination by leaded gasoline in the 1980s. A more realistic baseline for lead should be the levels measured in captive condors prior to release. Captive-reared condors tested at zoos before transfer and release from holding pens have blood lead levels ≤4 μg dL^{-1}, with a few exceptions when blood lead levels of 7 and 8 μg dL^{-1} were reported (C. Stringfield pers. comm.). These exceptions indicate that some condors may have access to unknown lead sources at zoos or holding facilities, such as lead paint, or possibly lead in zinc galvanized wire, solder joints, or other electrical wiring. By contrast, as discussed above, lead levels in free-living condors are typically ≥10 μg dL^{-1}. Fry and Maurer (2003) and Fry et al. (2009) have used 10 μg dL^{-1} as the background limit, with values above that interpreted as representing acute or chronic lead exposure.

Lead exposure and kinetics of lead clearance.—Fry and Maurer (2003) calculated the half-life of lead in the blood of condors as 13.3 ± 6.5 days, from a limited number of pairs of blood samples of birds held in captivity without chelation. Additional analysis has shown a shorter half-life of about 9 ± 6 days, with considerable variation among individual birds (Fry et al. 2009). This indicates that after an acute exposure event, blood lead levels decrease rapidly, and an acute exposure as high as 100 μg dL^{-1} will fall to ~10 μg dL^{-1} within 30–45 days. The field data (see above) thus suggest that condors are frequently exposed to lead while feeding in the wild, given that a high proportion of condors exhibit elevated blood lead levels when tested at random, despite the fact that blood levels drop rapidly back to background levels when birds are no longer exposed to lead. The data from the captive birds indicate that condors can recover quickly if sources of lead exposure are removed.

Condors discovered to be exposed to high levels of lead in the wild are generally held in captivity, treated to reduce the amount of lead in blood, and evaluated as to whether lead fragments are present in the gastrointestinal tract. Treatments include purging the gut with oral slurry doses of psyllium husks to physically push particles through the gastrointestinal tract or removing fragments by endoscopic or other surgical procedures. Birds with high blood lead levels, generally >50 μg dL^{-1} but occasionally lower, are treated with chelating agents to chemically bind the lead and remove it by excretion via the kidneys (Parish et al. 2007, Sorenson and Burnett 2007).

Chelation therapy provides a temporary lowering of lead levels in acutely exposed birds, but blood lead levels may rise again within weeks as lead slowly reequilibrates back into blood from soft tissues such as liver, kidney, and muscle, causing a rebound in blood lead levels after chelation (Marcus 1985). Birds that are chronically exposed will also have lead slowly deposited in bone (Schutz et al. 1987). The sublethal consequences of this chronic, moderate to high blood lead level are unknown in condors and other birds but are recognized as a debilitating neurotoxic response in humans (Canfield et al. 2003, Kosnett 2009, Pokras and Kneeland 2009, Watson and Avery 2009).

In Arizona, as of 2007, condors exhibiting high lead levels have been chelated on an emergency basis on 124 occasions, including multiple treatments of the same individuals in some cases (C. Parish pers. comm.). There are likely long-term consequences of repeated sublethal lead exposure, and probably consequences of repeated exposure to chelation drugs (primarily calcium EDTA and/or succimer [2, 3-dimercaptosuccinic acid]), as well as the stress and trauma risks of capture, handling, and treatment. The drastic steps taken in trapping and veterinary intervention on a recurring basis for birds in Arizona and California require a high investment of time and effort on the part of the field teams and significantly alter the "wild" status of the birds. An examination of behavior and demography of condors as a function of the number of times they have been chelated, as well as studies of sublethal and developmental effects of lead, are critical research needs.

The issue of condors being able to feed on their own rather than sustained by carcasses put out for them at feeding stations (see below) is also tied to the lead issue. Managers must feed birds to be able to trap them to treat for lead poisoning.

Efforts to eliminate lead from the food sources of condors.—There are various approaches for eliminating exposure of condors to lead ammunition fragments. The actions of other nations offer several possibilities as lead ammunition is increasingly recognized as potentially deadly to fish and wildlife (Avery and Watson 2009, Mateo 2009, Thomas 2009). A federally mandated, national switch to nonlead ammunition such as Japan has adopted to protect White-tailed Eagles (*H. albicilla*) and Steller's Sea-Eagles (*H. pelagicus*) is one example. In the United States, the National Park Service has indicated that it will begin to phase out the use of lead ammunition on its lands by 2010 to avoid both harm to wildlife and the danger of dissolved lead contaminating groundwater. Working through local hunters and national organizations for a voluntary conversion to nonlead ammunition is another approach. Arizona's Game and Fish Department has developed a successful voluntary program to replace lead with nonlead ammunition in an important condor foraging area in that state (Sullivan et al. 2007, Green et al. 2008, Sieg et al. 2009; see below).

Copper or other nonlead bullets can be a solution to the lead problem (Oltrogge 2009). Copper is much less toxic than lead, and copper bullets do not fragment into small pieces as lead bullets do. Although large pieces of copper could pose a risk, we believe that the risk will be small compared with the current risks of lead exposure. Those we interviewed indicated that the ballistics of copper bullets match or exceed those of lead (see also Schulz et al. 2009). The only issues with substitution of copper for lead bullets raised in our interviews are that the former are currently more expensive and are not readily available in some calibers.

A growing awareness of the adverse environmental effects resulting from use of lead ammunition is reflected in the variety of recent actions, some mandatory and some voluntary, designed to replace lead with nonlead ammunition (Thomas 2009). The most significant of these is legislation passed in California in 2007 (the Ridley-Tree Condor Preservation Act, AB 821) requiring the use of nonlead ammunition in big-game hunting within the range of the condor in California. In addition, the California Fish and Game Commission adopted regulations in December 2007 to require the use of "lead-free" ammunition, including .22 rimfire cartridges, for all forms of hunting (excepting upland game-bird hunting) within the condor range as of 1 July 2008. California Fish and Game also requires copper ammunition for killing pigs and deer in agricultural areas.

The Tejon Ranch, which has a major hunting program for pigs, deer, elk, bears, pronghorn, upland game birds, and varmints including coyotes, bobcats, badgers, gray foxes, and ground squirrels, switched to the use of nonlead ammunition, including .22 rimfire ammunition, in January 2008 (Hill 2009). This action is part of a Habitat Conservation Plan that is the result of a long negotiation with the USFWS. Two military installations with hunting programs within the foraging range of the condor, Camp Roberts and Fort Hunter Liggett, also require nonlead ammunition.

These are very important steps toward reducing exposure of condors to lead, but their effectiveness will depend on education and enforcement. Enforcement of lead-free hunting regulations may be problematic because of the lack of enforcement personnel to apprehend violators, and the difficulty for enforcement officers of distinguishing between lead and nonlead ammunition in the field and documenting any illegal shooting with lead ammunition. Thus, it will be critical to assess the effectiveness of these regulatory actions in eliminating lead ammunition. Ensuring that nonlead ammunition is used in recreational shooting of ground squirrels and other small animals is another enforcement issue (Schulz et al. 2009).

The impact of the actions taken in California remains to be seen, but until their efficacy is demonstrated we are not convinced that they will reduce incidences of lead poisoning of condors sufficiently to enable self-sustaining populations as long as lead ammunition is freely available, because of issues with compliance and enforcement. Tejon Ranch's new policy was implemented through notification by word-of-mouth and letters to all hunters, followed up later by spot checks in the field (Hill 2009). Yet, in the spring of 2008, high lead levels were detected in seven condors in southern California, and global positioning system (GPS) data indicated that condors carrying transmitters had been feeding on Tejon Ranch in addition to using provisioned carcasses at Bitter Creek NWR. These birds were taken to the Los Angeles Zoo for treatment, and one subsequently died. There was speculation that the birds may have ingested lead in carcasses available through Tejon's year-round pig-hunting program. This possible exposure event caused Tejon to close down their hunting program for a 1-month review and resulted in tightening of their enforcement program. The possibility that condors were exposed to lead-contaminated pig carcasses on the Tejon Ranch despite the prohibition of lead ammunition points to the necessity of enforcement to ensure compliance with nonlead regulations and to the difficulty of achieving 100% compliance even in highly controlled hunting programs.

Enforcing the statewide prohibition on lead ammunition in California could be similarly problematic. The Ridley-Tree Condor Preservation Act provides for subsidies to hunters for nonlead ammunition, but California has not provided any funding for the program. Still, early indications are that compliance may be sufficiently high that enforcement may not be an issue: in February 2009, California Department of Fish and Game reported that a survey of hunters indicated that 99% complied with the nonlead ammunition requirement in 2008. One problem is that poachers take large numbers of animals in California and are unlikely to comply with the nonlead requirement, as long as lead bullets are easily purchased.

Because the Arizona condors are considered an experimental population (see below), in the Southwest the lead issue has been addressed through voluntary programs rather than mandatory regulations. The Peregrine Fund has teamed with the Arizona Department of Game and Fish to encourage hunters to use copper bullets in areas where condors feed (Sullivan et al. 2007). Having identified the deer hunt on the Kaibab Plateau as the primary source of lead exposure in Arizona, they initiated a public education program for all hunters drawing permits for that hunt and provided them with lead-free ammunition at no charge. Outreach efforts have been highly successful, with voluntary compliance by >80% of hunters (K. Sullivan pers. comm.). Despite this success, condors continue to be exposed to lead while foraging on the Kaibab and when ranging beyond the Arizona border. The failure of the Arizona program to significantly reduce exposure of condors to lead is one of the reasons we are skeptical about the effectiveness of voluntary, and even mandatory, local prohibitions of lead ammunition.

In Arizona and Utah, birds have access to a large supply of their preferred food, deer, during the late summer, fall, and early winter. Green et al. (2008) modeled exposure and cleansing of the population during the hunting season and concluded that without trapping and intervention, sufficient mortality would occur in the population to prevent sustainability, even at the current high rate of compliance in use of lead-free ammunition by deer hunters in the Kaibab Plateau. Previously, Woods et al. (2007) reached the same conclusion on the basis of an assessment of field data. In future years, as more birds move into Utah during the hunting season, the problem will become worse unless a very successful hunter-education program is undertaken and hunters widely accept the use of lead-free ammunition (Sullivan et al. 2007). Even so, Green et al. (2008) hypothesized that only a few lead-exposed carcasses would be sufficient to cause mass mortalities of condors if there is not a successful way of trapping birds during the hunting season in Arizona and Utah.

Exposure of condors to lead fragments in carcasses is analogous to die-offs of Asian vultures in which populations of several species have been reduced nearly to extinction because of feeding on cattle carcasses that contained the veterinary drug diclofenac (Oaks et al. 2004). Diclofenac is a very effective nonsteroidal anti-inflammatory drug, but if a treated animal dies, a single carcass may contain multiple lethal doses of toxicant and can poison multiple birds feeding communally. Green et al. (2004) created models of exposure scenarios to determine the proportion of carcasses that needed to be contaminated to adversely affect the population of Asian vultures feeding on carcasses and found that if as few as 1% of the carcasses contained diclofenac, they would intoxicate so many individuals that the vulture population would not be sustainable.

Lead and condor recovery.—We are convinced that condor recovery cannot be achieved unless exposure to lead from ingesting ammunition fragments while feeding on carcasses and gut piles is eliminated. On the other hand, we also believe it is quite possible that wild populations that did not require human intervention to be self-sustaining could be established were this threat removed. We are skeptical that, even with excellent compliance, voluntary programs promoting the use of nonlead ammunition can reduce lethal exposure to lead sufficiently to wean condor populations from constant veterinary care. Similarly, the efficacy of area-specific requirements for nonlead ammunition such as the local regulations on the Tejon Ranch or even the state regulations in California remains uncertain, especially when some legal uses of lead ammunition are retained in those areas. Replacement of lead with nonlead ammunition needs to be achieved on an ecologically relevant scale and thereby positively affect survival rates over all or a significant portion of the condor's range if self-sustainability is to be achieved. We predict that if lead ammunition remains available, some of it will find its way into carcasses on which condors feed, sometimes in unanticipated ways. In Baja California, 11 birds, constituting half of the population, had to be treated for lead poisoning because the cows used for their supplemental food supply apparently had previously been shot with .22 caliber lead ammunition by vandals (E. Peters pers. comm.).

We submit that condor recovery will not be possible until exposure to lead in their food sources is totally eliminated. The effectiveness of voluntary programs and regulations targeted toward particular types of ammunition in particular areas will soon become apparent. If such partial regulation proves insufficient, some will likely suggest a national ban on lead ammunition, similar to the ban on lead shot for waterfowl hunting (Friend et al. 2009). Progress toward recovery is not sustainable under current conditions because reintroduction of more condors simply increases the costs required to keep free-living birds alive rather than improving the ability of the free-living populations to persist without human assistance. The program thus has reached an impasse involving tradeoffs between number of birds, mortality rates, and program costs. As more condors enter the population, partners may be unable or unwilling to sustain the increased level of support required to prevent mortality rates from lead ingestion from rising. The ultimate goal of many of the partners is to be involved in lower-intensity monitoring of populations that are not reliant on human intervention to be self-sustaining, or to exit the program entirely when populations reach this point, not to continue increasing expenditures indefinitely. That goal is unattainable as long as the lead threat remains, and the longer the lead issue continues to impede progress, the more difficult it will be to sustain the support of existing partners or secure additional support for the recovery program.

The USFWS is the agency responsible for achieving recovery, including resolving the lead issue. However, neither the USFWS nor any of the other federal recovery partners has the statutory authority to regulate the use of lead ammunition outside of their lands. Coordination among land management and regulatory agencies could provide a means of addressing lead exposure of condors over a meaningful spatial scale. This could also assist federal land managers in meeting their recovery obligations under the ESA (see below). Also, the USFWS can make the case for eliminating lead ammunition to those agencies that have authority to bring about such action, and to the public. State wildlife agencies play a critical role because of their jurisdiction over hunting regulations, and in California, Arizona, Utah, and Oregon these agencies are already fully engaged with the lead issue.

Replacement of lead ammunition with nonlead alternatives will take some time, as it did when lead shot was eliminated from waterfowl hunting (Friend et al. 2009). It will be essential to rally public support for such a change, and a gradual transition will impose fewer hardships on hunters, state wildlife agencies attempting to implement new regulations, and ammunition manufacturers and distributors (Thomas 2009). During this transition, much can be learned about the degree of compliance, enforcement capability, and effectiveness in reducing lead exposure in condors of various types of regulations. There is no danger that condors will disappear from the wild if it takes some time to complete the transition to nonlead ammunition, because managers are able to maintain populations, provided that adequate funding and personnel remain available to sustain the current intensity of intervention.

We conclude that a reduction in hunting, depredation permits, or other types of shooting would not promote condor recovery. Such actions might effectively reduce lead in the environment, but they would also result in a significant reduction in the condors' food supply. Humans are the dominant predators in most of the condor's range, and carcasses and gut piles resulting from hunting and other types of shooting are important food sources for condors. It is essential that humans continue to harvest deer, pigs, and other wildlife throughout the condor range—but using nonlead rather than lead ammunition, so that a clean source of wild food is available to condors beyond food subsidies. It is unlikely that condors could be sustained in the wild after food subsidies are reduced without this source of food. Emphasizing the importance of hunting to condors might be an effective means to gain support from the hunting community for conversion from lead to nonlead ammunition. It is also important that hunters be made aware of the potential for adverse effects of lead exposure from spent ammunition on other species, including humans (Thomas 2009).

The mortality risk to condors posed by lead ammunition is such that, under some circumstances, use of such ammunition could be considered "take" of condors under the ESA. The birds reintroduced in Arizona are classified as a nonessential experimental population under ESA section 10(j). Hence, they are treated legally as proposed for listing rather than endangered, except in national parks and national wildlife refuges where they are treated as threatened under the 10(j) rules. Condors in California and parts of Utah outside of the experimental population boundaries receive the full benefits of protection against incidental take provided by ESA sections 7 and 9. The USFWS and land management agencies may benefit from development of policy and guidelines that integrate current knowledge of lead impacts into management programs and ESA consultations. Such guidance could clarify whether the use of lead in hunting programs and depredation programs, considered individually and cumulatively, reach the regulatory and consultation thresholds under section 7 of the ESA and, if so, how these types of actions should be addressed.

A similar approach might be applied to "take" of condors attributable to microtrash ingestion (see below), whereby federal agencies would consider the impacts of microtrash in their land-use plans, issuing of oil and gas lease permits, and consultations with the USFWS. One possible outcome might be that the BLM and USFS would make removal of trash a requirement for lease and permit holders on public lands when activities conducted under such permits would create a source of microtrash (e.g., Hopper Mountain).

Foraging and Supplemental Feeding

Lead-free carcasses are provided at all condor release sites as a possible means of reducing exposure to lead. The potential effectiveness of this food subsidy as a means of keeping condors from consuming contaminated food was, in fact, a justification for initiating releases in the 1990s (USFWS 1996). At the time, it was believed that captive-reared condors might become strongly dependent on subsidies, as was observed in similar releases of Eurasian Griffon Vultures (*Gyps fulvus*) in France (Terrasse 1985) and Andean Condors (*Vultur gryphus*) in Peru (Wallace and Temple 1987, 1988). However, California Condors have not become strongly dependent on clean food subsidies at release sites, which parallels the findings from earlier feeding programs for the original wild population (Wilbur 1977, Snyder and Snyder 1989). Moreover, proffered foods have been provided at multiple locations at all release sites, especially in the 1990s, when efforts were made to lure the birds away from human activity. As the birds became more mobile and more adept at keying in on other scavengers, especially ravens, they quickly adapted to feeding at nonproffered sites. As released condors strayed from food subsidies, the incidence of lead poisoning increased, although the level of adherence to subsidies and the incidence of lead poisoning vary among sites. For example, adherence to subsidies has been strongest in southern California, where feeding stations have been few and nonproffered food sources appear to be limited (Snyder and Snyder 2000, Grantham 2007, Hall et al. 2007). By contrast, sites where adherence to subsidies has been weaker had multiple feeding stations to encourage exploration and more abundant nonproffered food, such as hunter-killed game in Arizona and dead marine mammals at Big Sur (Hunt et al. 2007, Sorenson and Burnett 2007, Woods et al. 2007). Overall, providing food subsidies has not proved to be an effective means to prevent condors from being exposed to lead.

Still, released condors make extensive use of subsidies, which are usually offered on a regular schedule (e.g., every 3 days) at a site or several sites relatively close together. Stillborn calves from dairies are the most common food, although other species are sometimes offered, depending on availability (Grantham 2007, Wallace et al. 2007). Although its effectiveness in achieving its original objective of reducing lead exposure is arguable, luring captive-reared condors to feeding stations has clearly been invaluable for flock management. For instance, releasing young, captive-reared condors near feeding stations promotes their socialization through interactions with older, experienced conspecifics and facilitates their integration into the free-living flock (Grantham 2007, Woods et al. 2007). Additionally, feeding stations allow for routine retrapping of condors to replace transmitters, conduct health checks (e.g., blood tests for lead or West Nile virus postvaccination antibody titers), and, when warranted, provide chelation treatment for lead exposure (W. Austin et al. unpubl. data). Thus, even in Arizona, where feeding on "natural" food has been especially emphasized for some time, managers still must offer food subsidies in order to trap, test, and treat birds once or twice each fall and winter when the birds return to the holding pen area after feeding on deer carcasses during the hunting season on the Kaibab Plateau. Recently, providing food at multiple, widely dispersed locations has been used to stimulate expansion of the birds' foraging range. Finally, attraction of condors to fixed feeding stations allows for routine observation and provides opportunities for experiments related to food choice or nutrition, such as providing bone chips to test the hypothesis that microtrash ingestion is related to calcium deficiency (Mee et al. 2007a).

Although feeding condors at fixed sites and fixed time intervals has been useful, it likely retards development of normal wide-ranging foraging behavior, alters time and energy budgets, and may adversely affect other natural behaviors (Mee and Snyder 2007). For instance, food subsidy has been hypothesized to disrupt the normal pattern and rate of food delivery to nestling condors by their parents (Mee et al. 2007a). Possible effects include increased synchrony in food deliveries to the chick, more frequent periods of food deprivation, and inability of subordinate pairs to secure a full crop or the more nutritious parts of a carcass. Also, as discussed more fully below, condors that rely on food subsidies may use some of their "excess" time that normally would be devoted to extensive searches for carrion to engage in unnatural or inappropriate behaviors, such as the exploration of human-developed sites and ingestion of trash (Mee and Snyder 2007).

Fig. 6. California Condors and a Golden Eagle at a protected feeding site. (Photograph courtesy of U.S. Fish and Wildlife Service.)

As food subsidies have become predictable in space and time, feeding stations have attracted not only condors but also other scavengers and predators (e.g., feral pigs, coyotes, cougars, bears, bobcats, and Golden Eagles), thereby increasing competition and predation risk for condors. To deter food loss and interactions with mammalian predators and scavengers, "permanent" feeding stations have been protected with electric fences at two sites in southern California and similar protected feeding stations have been established in central California (Fig. 6). Although these protected feeding stations have reduced food loss to mammalian scavengers, risk of predation by Golden Eagles may still exist (Mee and Snyder 2007). Furthermore, these feeding stations can promote a high level of sociality among condors, as observed in southern California, where it is possible to find the entire reintroduced population of that area together at a feeding site (Mee and Snyder 2007). Such concentrations of condors at a single site were never observed in the wild population before its extirpation, because much of the condors' time was occupied in searching for food, leaving little time for aggregating at a site (Meretsky and Snyder 1992). The effects of high levels of sociality at feeding sites are unknown, but it is likely that dominant birds control the food source, making it difficult for young birds and less dominant condors to obtain food. High levels of sociality may also increase the risk of disease transmission.

Given that food subsidy at a fixed site or a few fixed sites near the release site is required to trap and treat birds for lead exposure, most problems that arise from subsidy cannot be alleviated until the lead problem is solved. Increased linkage of monitoring with foraging patterns and lead exposure would be useful in developing a feeding strategy. Once the lead issue is solved, problems associated with food subsidy will likely diminish, and those that remain may become more tractable to management intervention. Continued food subsidy may be required at sites with inadequate food supplies or seasonal shortages of carrion, such as in Arizona, where condors may continue to require subsidized food during the winter (Hunt et al. 2007). In fact, it is not yet clear whether condors could subsist without food subsidies at any of the reintroduction sites. The impact of feral hogs as scavengers on the condor's food base is one concern, and all the changes in the landscape wrought by humans over the last 200 years is another. Investigation of this issue, including experimentation, could help prevent this from becoming the next impediment to condor recovery once the lead problem is solved.

Foraging habitats at reintroduction sites vary considerably and include beaches and coastal redwood forests at Big Sur, oak savannas, grasslands, and chaparral at Pinnacles National Monument, grasslands and oak savannas in southern California, high desert and forested plateaus in Arizona and Utah, and arid scrub habitats of Baja California. This variety provides a rich context for studies of the foraging abilities and requirements of condors on current landscapes. Their ability to feed on marine mammals is an encouraging development with respect to the potential food base in central California and farther north. At this point, southern California appears to be the most problematic area as far as natural foraging potential is concerned, but the recent protection of habitat on Tejon Ranch, the gateway between historical foraging ranges of the southern California population in the coastal ranges and the southern Sierra Nevada (Wilbur 1978), provides opportunities for this area.

We recommend continuing research on the capacity of condors to become self-sufficient foragers within the extant landscapes where they are being released, and we endorse recent efforts in southern California and elsewhere to encourage condors to forage more widely and rely less on proffered food. The condors currently on the landscape are pioneers. We learn much from them, albeit at some cost to the birds and the partners involved in the condor program. Although encouraging condors to explore a larger landscape may increase the risk of lead exposure, it provides benefits in learning opportunities.

Undesirable Behavior of Released Birds

From the first releases of captive condors back into the wild, the behavior of released birds, specifically their attraction to humans and human-built structures (Fig. 7), has been an issue (Snyder and Snyder 2000). The inquisitiveness of condors makes tame birds unusually prone to interact with humans, and because of their large size and gregariousness such interaction is inevitably problematic. As a consequence of the condor's social nature, undesirable behavior can be contagious: well-behaved birds can learn undesirable behaviors from other condors. The survivors among the first birds released in 1992 and 1993 were recaptured and returned to captivity because of their tameness, general attraction to human activity, and tendency to engage in the high-risk behavior of perching on utility poles (USFWS 1996). Subsequent examples of undesirable behavior range from mundane destruction of property to the truly fantastic. In southern California, a cohort of birds reared and released together began associating with hang-gliding enthusiasts on weekends, roosting on a communication tower at the launch site, mingling with the humans on the ground to pick through food wrappers and other trash, and soaring with the hang-gliders when they took to the air (Mee and Snyder 2007, J. Grantham pers. comm.). Another group of condors descended on the Pine Mountain Club property near Mt. Pinos in 1999, destroying satellite dishes, roof shingles, and a screen door, and entering the bedroom of one home to take bites out of a mattress (Snyder and Snyder 2000).

Fig. 7. California Condors attracted to a human-built structure. (Photograph courtesy of U.S. Fish and Wildlife Service.)

Many in the condor program believe that supplemental feeding promotes development of undesirable behavior involving attraction to humans and human-built structures because it provides birds with more time for activities other than foraging (Mee and Snyder 2007). This is debatable, whereas it is clear that captive-rearing and socialization techniques affect the expression of undesirable postrelease behavior (Bukowinski et al. 2007, Clark et al. 2007, Wallace et al. 2007). Since the first releases, development of rearing and release techniques that produce well-behaved birds has been a major issue and an important focus of research, conducted largely through trial and error. Much progress has been made, especially in recent years (Clark et al. 2007, Wallace et al. 2007). In general, two rearing methods are used, parent-rearing and puppet-rearing (Wallace et al. 2007). Condors learn survival skills and appropriate social behavior through interaction with other condors (Wallace 2000, Alagona 2004), and in the wild, young birds learn from their parents during a long period of dependence (Snyder and Snyder 2000). In the early years of the program, puppet-reared birds were raised in cohorts and thus lacked adult mentors (Bukowinski et al. 2007). These birds were prone to undesirable behavior (Meretsky et al. 2000, 2001; Snyder and Snyder 2000) and were seemingly lacking in social skills (Cade et al. 2004) and wariness of humans (Meretsky et al. 2001). The puppet-rearing procedure has subsequently evolved to include interaction with older mentors as an important component of the rearing routine (Clark et al. 2007). In addition, birds are now held in outdoor pens at release sites for a considerable period and have further opportunities to learn from mentors placed within the pen, as well as through interactions with free-living birds that visit the pen. Thus, birds are integrated with the existing flock to some extent before they are released. Both puppet-rearing and parent-rearing are currently producing birds that behave appropriately, and there is no difference in postrelease survival between birds raised by these two methods (Woods et al. 2007).

Rearing-and-release now involves close integration between captive and field facilities geared toward releasing a well-behaved bird and managing subsequent behavior in the field. Managers have learned to recognize appropriate and undesirable behavior and monitor individuals closely to decide if and when a bird is suitable for release. Such monitoring continues after release, and problem birds are caught and returned to captivity for a "time-out" period of months or years during which they undergo behavioral rehabilitation or are moved to another release site. Intensive monitoring is also required so that managers know when to apply negative reinforcement (i.e., hazing) in response to undesirable behavior. This may be effective in deterring young condors from approaching humans or their structures; it was effective in Arizona (Hunt et al. 2007), but not in southern California (Grantham 2007). Similarly, managers in Arizona employ hazing to deter newly released condors (including older birds) from roosting on the ground, where they are vulnerable to predators (Woods et al. 2007). Negative reinforcement in the form of aversion training of young birds prior to their release has also been effective in discouraging condors from landing on utility poles, contributing to a reduction in power-line-related mortalities (Mee and Snyder 2007). Undesirable behavior is much less an issue today than it was previously, but occasional problem individuals that interact inappropriately with humans or other condors still occur, and one pervasive behavioral problem, microtrash ingestion in southern California, still exists. Perhaps the biggest change is that managers have gotten much better at recognizing undesirable behavior earlier and removing individuals that exhibit it from the free-living populations before they cause problems.

There is widespread belief among the program's biologists that parent-rearing is superior to puppet-rearing in producing desired behavior (Meretsky et al. 2000, Wallace et al. 2007). Although unequivocal evidence that this is so is lacking, we support a preference for parent-rearing on the general principle that reducing reliance on humans is desirable. However, because breeding pairs will renest when their eggs are removed and sometimes fail in raising young, puppet-rearing results in considerably higher productivity than parent-rearing (Wallace et al. 2007). Hence, there may be tradeoffs between producing a better bird for release versus producing a greater number of birds. The current emphasis on parent-rearing is facilitated by the fact that some release sites, for example the one in Arizona, are at or near capacity in terms of the number of birds that they can handle given the intense postrelease monitoring and treatment requirements. Use of puppet-rearing will increase if demand for birds for release increases in the future, and, hence, further research designed to improve the puppet-rearing technique, such as the current study in Baja California (Wallace et al. 2007), is warranted. Carefully designed experiments such as this one, as opposed to the trial-and-error approaches of the past, will provide the most definitive results (Meretsky et al. 2000). Designing experiments that will produce clear interpretations is challenging, however, because of the influence of the existing free-living flock on the behavior of newly released birds. Indeed, one of the current issues is the extent to which improved behavior in recent years is attributable to more use of parent-rearing versus the presence of older free-living mentors. This issue was avoided in the Baja California experiment because there was no previously existing flock there. We encourage others to conduct a similar experiment with parent-reared and parent-socialized birds if such an opportunity arises in a new and separate release area.

There is good coordination between rearing methods and demands at release sites among partners that work closely (e.g., Boise-Arizona, San Diego-Baja, Los Angeles Zoo-Bitter Creek), and this is reflected in the emphasis on parent-rearing in Boise and the Los Angeles Zoo, and in greater use of puppet-rearing at San Diego. However, matching overall demand with overall production across the program may need some attention. In particular, the central California release site (Big Sur and Pinnacles) would like more birds than they are currently receiving. At the program level, genetic and demographic considerations drive decisions about how many and which birds are available for release (Ralls et al. 2000, Ralls and Ballou 2004). Currently, an age structure skewed toward the older age classes in the captive population is a particular concern (M. P. Wallace et al. unpubl. report, K. Ralls pers. comm.). To correct this problem will require that some of the young birds produced be retained in captivity, thereby reducing the number available for release. Therefore, decisions will need to be made on the basis of prioritization among the competing needs for retaining more birds for breeding, reducing the incidence of undesirable behavior (parent-rearing), and producing more birds (puppet-rearing) for release. In our opinion, reducing the incidence of undesirable behavior is the most important of these needs. Annual breeding and transfer recommendations should follow established procedures for Species Survival Plans in coordination with the Population Management Center at the Lincoln Park Zoo.

Despite the great progress that has been made in developing rearing techniques that produce well-behaved birds, concerns about undesirable behavior remain. For example, in central California, program managers are concerned that condors have frequent opportunities to interact with people in Pinnacles National Monument and on the coast along Highway 1, where birds roost immediately adjacent to the highway above the coastal colonies of sea lions. Thus, there is a continuing need for postrelease monitoring and behavioral management of released birds.

There is room for further experimentation with rearing techniques as well. In general, the improvements that have been made represent shifts toward procedures that more closely resemble natural processes of rearing and socialization, the emphasis on parent-rearing being the most obvious example. Rearing techniques could be shifted further in this direction (Mee and Snyder 2007). Leaving chicks with their parents for a prolonged period and delaying mixing of young birds until the age when they naturally would separate from their parents represent such shifts. There is some concern that exposing young birds to one another at an early age could trigger incest-avoidance mechanisms and thereby affect pair bonding (Hartt et al. 1994, Mee and Snyder 2007). Once the lead problem is solved, we recommend the release of established breeding pairs from the captive population. Old birds from the original free-living population should be included in these releases because their knowledge could be invaluable in reestablishing traditional seasonal movements and foraging patterns (Mee and Snyder 2007). For example, older birds might lead younger condors back to historical foraging grounds in the Sierras.

We conclude that undesirable behavior is no longer an impediment to reestablishment of free-living condor populations. Sufficient progress has been made in refining captive-rearing and release techniques to produce appropriate behavior, and in managing behavior after release, that undesirable behavior is confined to individual cases that are quickly addressed. Still, more work is needed to reach the point where it is no longer necessary to manage the behavior of free-living condors. In the meantime, the close integration between captive and field facilities in managing behavior should continue, with continued emphasis on parent-rearing while demand for birds for release remains relatively low. Until the lead problem is solved, the quality of the birds produced, not their quantity, is paramount.

Microtrash ingestion.—Condor parents feeding nestlings small items of trash has been the major cause of nest failure in southern California. While hatching success in this reintroduced population compares well with that documented in the historical condor population and other vulture species, fledging success has been substantially lower than expected (Mee et al. 2007a, b; Snyder 2007).

Of 12 nestlings hatched in the wild in southern California between 2001 and 2006, eight died before fledging (Table 2). Although only two deaths (nestlings SB#285 and SB#308) can be directly attributed to trash, trash ingestion was probably a contributing factor in the deaths of five additional nestlings. Between 2001 and 2006, only a single nestling (SB#326) successfully fledged without assistance, although three other nestlings (SB#328, SB#370, and SB#412) were removed from the wild for medical treatment and were either returned to the nest or rereleased into the wild following their recovery. Nestling SB#328 had 222 g of foreign material removed by surgery yet appeared to be healthy, whereas nestling SB#370 had 200 g of microtrash removed by surgery and was clearly debilitated. Ingested items are diverse and have included rags, nuts, bolts, washers, plastic, chunks of pipe, bottle caps, spent cartridges, and pieces of copper wire. Mee et al. (2007a) examined 650 trash items recovered from condor nests and nestlings and determined that 226 (34.8%) were plastic, 223 (34.3%) were glass, 148 (22.8%) were metallic, and 53 (8.1%) were other materials (Fig. 8). They found that trash items were significantly more numerous, larger, and of greater mass in reintroduced condors' nests than in historical nests.

Because of the problems posed by microtrash ingestion, and following a successful intervention in 2006 in which a chick from which microtrash was surgically removed subsequently fledged, the USFWS initiated an intensive nest-monitoring program in southern California in 2007. Nestling feather growth and development are carefully monitored because trash ingestion can cause distention of the crop and gizzard and interfere with food uptake and processing. During nest visits, nestlings are palpated and checked with a metal detector to ascertain the presence of metallic trash. Trash items are removed from the floor of the nest

Table 2. Causes of posthatching nest failure of California Condors in California, 2001–2006 (modified from Mee et al. 2007a).

Primary cause	Effect: Dead	Effect: Removed	Percentage	Additional data (number of nestlings affected)
Ingested trash	2[a]	2[b]	36	Zinc toxicosis (1), retarded growth (2), elevated copper (2), anemia (1), pneumonia (1), perforated gut (1)
Undetermined	3		27	Elevated copper (2), ingested trash (2)
Trauma	1[c]		10	Head and neck wounds
Dehydration		1[d]	9	Visceral gout, ingested trash, elevated copper
Fall from nest	1[e]		9	Ingested trash, broken wing
West Nile virus	1		9	Aspergillosis, ingested trash, retarded growth

[a] Chick SB#308 was removed from the wild on 11 September 2003 (~133 days of age) and was subsequently euthanized at Los Angeles Zoo on 24 September 2003.

[b] Chick SB#370 (116 days of age) was rescued from the wild in 2005 for surgery and treatment and was rereleased to the wild in 2006. Chick SB#412 (~130 days of age) was removed from its nest to Los Angeles Zoo in 2006 for emergency surgery for impaction at Los Angeles Zoo, was returned to its nest the next day, and survived to fledge.

[c] Chick SB#263 died at ~2 days of age in 2001. The chick was derived from a captive-produced egg placed in the nest of a "trio" (1 male, 2 females) of adults when their two eggs were not viable. Wounds possibly resulted from adult aggression. Adult female SB#108 was subsequently removed from the wild.

[d] Chick SB#288 died at 145 days of age and had gone at least 6–8 days without food during hot weather.

[e] Chick SB#328 was found below the nest cave with a broken wing. The 131-day-old chick was taken to the Los Angeles Zoo for surgery to repair the wing and remove trash. The chick recovered and was subsequently rereleased to the wild in 2006.

cavity, and bone fragments are provided. Nestlings are also vaccinated for West Nile virus during these examinations. During the 2007 breeding season, all six breeding attempts were successful, although two fledglings were subsequently lost (SB#434 to a wildfire and SB#444 to an unknown cause). As of July 2008, microtrash had been found in four of five nests in southern California, and some chicks had microtrash in their digestive tracts (J. Grantham pers. comm.). We conclude that successful nesting in southern California is currently contingent upon intensive nest monitoring and corrective intervention when needed, and we recommend that this monitoring, although it is time- and labor-intensive and costly, be continued until the behavior of feeding microtrash to chicks ends. In our opinion, the rationale for such monitoring is reasonable: it is more desirable to have a chick fledged naturally into the wild by free-living parents than to raise and release a captive-reared chick, and a wild-reared chick will likely adopt natural behaviors more quickly than a captive-reared one.

Fig. 8. Microtrash from a California Condor nest in southern California. (Photograph courtesy of U.S. Fish and Wildlife Service.)

Although areas with abundant trash (e.g., oil platforms and visitor overlooks) that are frequented by adult condors are being identified and cleaned up, it seems unlikely that this effort alone will solve the trash ingestion problem, given the scale and diversity of these sites (Mee et al. 2007a, J. Grantham pers. comm.). The question as to why condors feed trash items to their chicks remains unresolved and clearly merits additional investigation. Trash ingestion may represent a misdirected search for calcium and food sources needed for egg laying and chick growth and development, as documented in other large vultures (Mundy and Ledger 1976, Richardson et al. 1986, Benson et al. 2004, Houston et al. 2007). Although provisioning of calcium sources (i.e., bone fragments and small mammals) at feeding sites in southern California did not seem to reduce the quantity of trash delivered to nestlings, these items were provided irregularly and in inadequate amounts to rigorously test this hypothesis (Mee and Snyder 2007; Mee et al. 2007a, b). Additional efforts to test this hypothesis are warranted, and we agree with Mee and Snyder (2007) that studies on pellet formation and regurgitation in adults and chicks as well as on the timing and rate of bone mineralization in nestlings could provide valuable supplemental information.

Microtrash ingestion has been especially common in the southern California release population, where trash ingestion has caused chick mortality (Mee et al. 2007a, b). Incidence of microtrash is not as well documented in Arizona as it is in southern California because nests are visited less frequently in Arizona. However, reasonable nest success rates (Woods et al. 2007) and observations when nests are visited indicate that trash ingestion by chicks is not nearly as common in Arizona as in southern California and is not an important factor in chick mortality. Some site differences in the frequency of trash ingestion by chicks are attributable to differences in the availability of trash—the southern California site has an abundance of trash (especially along roadsides and oil drilling pads) in the vicinity of nest sites, in contrast to the more pristine environment of northern Arizona. It also has been suggested that the Arizona condors have a lower propensity to bring trash to the nest because they forage more widely on a variety of natural carrion and display less reliance on subsidized food (Mee et al. 2007a). Moreover, in the past, the Arizona nests were farther from the provisioning site (some are up to 80 km away) than southern California nests, all of which were in the vicinity of the provisioning site (1.5–12 km) until recently. Therefore, it has been hypothesized that regardless of the food source, breeding pairs in Arizona foraged more widely and had less time available to search for trash (Mee et al. 2007a, b; Mee and Snyder 2007). As of July 2008, however, feeding sites are now 72 km from nest sites in southern California, yet GPS telemetry data indicate that some breeding adults continue to make stops at prospective trash sites on their way to or from feeding sites, and microtrash continues to appear in nests (J. Grantham pers. comm.). Thus, the microtrash issue continues to defy simple solutions.

Nest observations in southern California suggest that nestlings now receive more irregular feedings than historically, a feature that may be related to the timing of food availability at feeding stations and may also influence trash ingestion behavior (Mee et al. 2007a). We agree with Mee and Snyder (2007) that experimental and observational examination of relationships between the regularity and spacing of feedings and the frequency of trash ingestion would be of considerable value. It was during periods of food deprivation that nestling Cape Vultures (*Gyps coprotheres*) were most likely to ingest foreign materials, including human artifacts and nest material (Benson et al. 2004).

The recent requirements for nonlead ammunition within condor habitat in California opens up the possibility of eventually reestablishing more natural foraging patterns in this population by providing a larger number of more widely distributed feeding stations, thereby inducing birds to travel much greater distances. Relocation of the release site and primary feeding station in southern California from Hopper Mountain NWR to Bitter Creek NWR in 2006 (Fig. 3), a distance of 72 km, was the first step in this direction. Establishment of additional feeding stations at Tejon Ranch and Wind Wolves Preserve in 2008 following adoption of the nonlead requirement represents a further attempt to alter adult movements and activity budgets and recreate historical geographic foraging patterns. Whether these changes will eventually reduce the incidence of microtrash ingestion remains to be seen, but clearly altered foraging and activity patterns did not immediately extinguish such behavior in the individuals that had a tradition of picking up trash (see above). Extant foraging patterns are still far less extensive than those documented historically, however, and we recommend that additional experiments designed to increase parental foraging time and effort be undertaken as soon as lead risks can be minimized and addressed. Perhaps development of more natural foraging patterns will prevent new breeders from acquiring the microtrash habit.

Adult condors also seem to vary considerably in their propensity to feed trash to chicks and may not visit trash sites until they are feeding nestlings (J. Grantham pers. comm.). Suggestions on how to deal with individuals that habitually pick up trash range from aversive training to relocating the birds to reestablished populations in Arizona or Baja California, where trash is much less available. One breeding pair that regularly fed microtrash to their nestlings were returned to captivity and subjected to aversive training, but they quickly resumed the behavior when they were returned to the wild in southern California. To date, there have been no attempts to transfer "problem" birds or pairs from southern California to other release locations. Whether microtrash ingestion can be modified or extinguished through aversive training is uncertain. No quantitative results were obtained from the one pair subjected to aversive training because the video recordings of the training sessions were lost as a result of equipment failure (M. Mace pers. comm.). We recommend that experiments with aversive training be undertaken in captivity as soon as practicable. Experiments involving young birds before their release and adults that have exhibited this behavior in the wild would be useful.

Early indications are that microtrash will not be as large an issue at the central California release sites as it has been in southern California. The first nesting in central California occurred in 2007, and only one of two nests contained any microtrash. Identifying the source and cleaning it up quickly eliminated the microtrash problem at that nest. This provides some hope that microtrash can be managed. The most promising avenues to pursue in reducing the microtrash problem appear to be (1) eliminating mictrotrash at sites frequented by condors; (2) returning adults that pick up microtrash to captivity for aversive training, as has been done for other undesirable behaviors; and (3) promoting more natural foraging patterns in nesting adults.

Exposure to Organochlorines

Of greater concern in central California is the possibility that contaminants accumulated through feeding on marine mammals could have adverse effects on survival and, especially, reproduction. These possibilities include long-term health effects associated with toxicants such as PCBs and eggshell thinning caused by exposure to DDE, to which condors and other raptors are purported to be sensitive (Kiff et al. 1979; Wiemeyer et al. 1984, 1988a; but see Snyder and Meretsky 2003). Iwata et al. (2000) showed that sea eagles feeding on marine mammals are exposed to DDE. Because breeding is just beginning in central California and the new breeders are young, it is currently difficult to evaluate this possibility, and early observations are equivocal. Initially no problems were evident, but in 2008 two eggs contained embryos that died during development from excessive moisture loss that may have resulted from thin-shelled eggs (J. Burnett pers. comm.). We recommend vigorous and timely investigation of the possibility that contaminants acquired by feeding on marine mammals interfere with reproduction in the central California birds. It is tempting to view carcasses of marine mammals as a panacea for condors living in coastal areas, but it is essential to make sure there are no issues with this food source. Specialized protocols need to be developed for collecting eggs and tissues of condors in central California in order to assess and monitor contaminants. Testing of samples and dissemination of test results in a timely manner has been a recurring issue with this work.

Programmatic Issues

Program Organization and Administration

Condor recovery partners are currently self-organized into a diffuse network (Fig. 9). The central elements of the recovery program are a large and diverse Recovery Team, a Field Working Group,

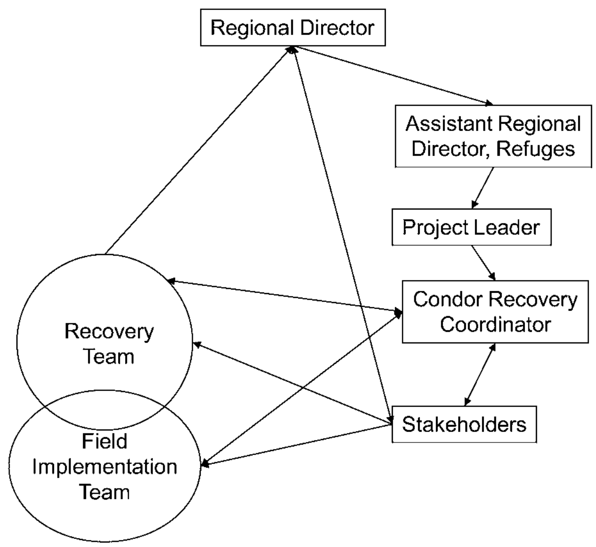

Fig. 9. Organization of the current California Condor Recovery Program.

and a USFWS condor recovery coordinator. The latter is housed near the southern California release site in Ventura, California, and is supervised by the Hopper Mountain NWR project leader. The 19-person Recovery Team is led by and primarily comprises active participants in the condor rearing, release, and monitoring programs and is weighted toward personnel from captive-breeding facilities. Meeting frequency has declined from semiannual to irregular. The Field Working Group, which was established several years ago, includes all technicians from the captive-propagation and release-management programs who are actively involved in restoring condors. They meet twice each year. There is also a veterinary coordinator charged with ensuring standardized care (e.g., vaccination policies), a pathology coordinator charged with conducting postmortem examinations and evaluating causes of mortality, and a Genetics Group (associated with the American Zoo and Aquarium Association and consisting of personnel from the Smithsonian's National Zoo and the Lincoln Park Zoo) that makes recommendations about pairings and transfers to optimize the genetic structure of the population.

Issues with current structure.—Efficient recovery programs require effective, adaptive, and typically task-oriented organizational structures (Clark and Cragun 2002). Except for the newly formed Field Working Group, which exhibits all these qualities, we rarely found these characteristics in the condor program. The position of condor recovery coordinator highlights many of the inefficiencies we discovered. The coordinator must monitor and lead a large program that involves two countries, three USFWS regions, and many state and private partners. However, because this position is located in a local refuge office, the coordinator must report to a supervisor in that office rather than directly to a senior manager in the regional office. This unnecessarily long hierarchy of authority and overuse of bureaucracy is characteristic of problematic implementation of the ESA (Yaffee 1982). Problems with long hierarchies certainly depend on the resources, desires, personalities, and leadership skills of the various supervisors. Multiple supervisors that are dedicated to a program could articulate a strong, unified voice for that program, but in practice this outcome is seldom realized, particularly when many of the supervisors have tight budgets and many competing demands besides the program in question. We conclude that placing the condor recovery coordinator in a refuge office unnecessarily links the coordinator to a single release site, reduces the coordinator's authority, and stifles the "virtuoso talents" needed by effective recovery-program leaders (Westrum 1994). Potentially, the long hierarchy of authority could also make it difficult for the coordinator to keep regional and national staff abreast of ever-changing and controversial issues affecting condors, to find program funding usually acquired at the national and regional level, and to work effectively with leaders of partner organizations who hold much higher-level positions within their own hierarchies. When condor recovery efforts were focused on reestablishment of the southern California breeding population, housing the coordinator at nearby refuges established for the condor made sense. But given the expanse of the condor program today, this structure no longer seems appropriate.

Housing the condor recovery coordinator at a local refuge office is not typical of national recovery programs. Most coordinators, especially for wide-ranging species like condors (e.g., Whooping Crane [*Grus americana*], Northern Spotted Owl [*Strix occidentalis occidentalis*], Gray Wolf [*Canis lupus*], and Grizzly Bear [*Ursus arctos horribilis*]), are assigned to USFWS Ecological Services field offices or regional offices. The coordinator for the Red Wolf (*C. l. rufus*) is an exception, being under the USFWS Refuges chain of command. But the Red Wolf has a narrow distribution in the southeastern United States and occurs almost exclusively on Alligator River NWR, where the coordinator is assigned. It makes sense to have the coordinator at the refuge in the case of the Red Wolf, but not in the case of the condor, whose refuge use constitutes such a small portion of the geographic range.

If the lead issue is resolved, new partners will certainly be needed to expand the program to new locations. In our opinion, the current program structure is not conducive to recruiting new partners. Program inequity and lack of shared and effective leadership make new partners feel uninformed and undervalued. They often feel out-of-sight and out-of-mind when it comes to programmatic decision-making and coordination. Similarly, stakeholders outside the program must navigate a confusing programmatic structure to voice concerns and remain informed about recovery. Increasing the profile of the condor recovery coordinator would provide stakeholders and new partners more effective entry to the recovery program. This would also enable the coordinator to better inform others that are not active partners, such as the BLM, USFS, and California Fish and Game, of program activities, especially when selecting new release sites. In the past, those affected by condors have not always been informed that birds were going to be released and would likely use their lands. It would be advisable to coordinate with other affected parties (e.g., utility companies) as well to avoid predictable problems.

The lack of funding for permanent field staff at the southern California release sites run by the USFWS is an issue. The success of the field program at Hopper Mountain and Bitter Creek depends on the dedication of interns and temporary employees who have little or no experience in working with such a highly visible, critically endangered species. There has been high turnover in the temporary positions, which has resulted in a lack of long-term continuity and familiarity with the species and strategies and techniques developed from working with large birds. When more experienced individuals fill these positions, operations tend to be more successful: the tremendous nesting success achieved at Hopper Mountain NWR in 2007 was heavily dependent on the efforts of two temporary USFWS employees who had the experience, passion, and commitment to make the program work. Results might decline dramatically with new, less experienced personnel in these key positions. Also, there needs to be someone above the field-supervisor level who has the bigger picture in focus. That individual should guide research and management, find funding, and have a direct connection with the field program.

By contrast, the Arizona site is staffed by a crew of 11, and with the base funding increase in the National Park Service budget, the central California release site will be staffed by two biologists and two or three interns from the Ventana Wildlife Society, plus five permanent biologists, two temporary biologists, and two interns from the National Park Service. This compares to one supervisory biologist, two GS-7 temporary biologists, two GS-5 temporary biologists, and interns in southern California, where the work load is heavier because of intensive nest monitoring. There is a critical need for additional funding from either the USFWS or program partners to adequately staff the southern California release sites. We question whether this release site can remain viable as currently operated.

The modest level of USFWS funding complicates general program administration, in that private partners must place their own budgetary needs before those of the cooperative recovery program. The level of investment by private partners also poses difficulties for program administration, in that the partners' need for autonomy in raising funds must be balanced with program coordination. A diverse partnership is essential in the condor program, and although this is bound to lead to some inefficiencies, the situation could be improved.

Finally, the Recovery Team is not fulfilling its role of providing leadership in implementing recovery. It has become overwhelmed by its many responsibilities as the program has grown ever larger. Its large size and a membership drawn mostly from program participants limit its effectiveness in providing a vision for the program, making recommendations to the USFWS, and coordinating new scientific investigations of key issues (e.g., foraging patterns, contaminants, land-use patterns and changes, and human demographics). The team has become a stakeholder group to some extent and receives relatively little input from independent scientists outside the program.

Proposed reorganization: A new approach to condor recovery.— That the current condor program has enjoyed as much success as it has is a tribute to the determination of all who have been, and are, involved with the program. However, continued realization that conservation-dependent species like condors require long-term, active management (Scott et al. 2005) demands that we do better. We conclude that the current structure of the program reflects past rather than current or future conditions and that a reorganization of this structure is overdue. We offer one possible reorganization that illustrates the kind of change that we believe is needed to enable the condor program to better adapt to existing and new challenges. Of course, our proposal does not represent the only possible effective structure, but rather is intended to convey the kinds of changes that could improve the program. The USFWS and its partners may be able to devise other structures that achieve the same ends.

(1) At the center of condor recovery would be a Condor Recovery Office (CRO) that works seamlessly with a Recovery Implementation Team (RIT) comprising those organizations that rear, release, and monitor condors (Fig. 10). Basic programmatic coordination would be the duty of the condor recovery coordinator. An additional, senior-level staff scientist would join the CRO as the condor research and monitoring coordinator. This senior endangered-species scientist would report to the recovery coordinator and would be reported to by the site-specific field supervisors. This arrangement would increase the ability of the CRO to coordinate recovery and the research on which it depends. Although coordination would be led by the CRO, all members of the RIT would share leadership of on-the-ground restoration efforts in a dynamic, problem-specific manner. The RIT would report directly to the recovery coordinator and interact directly with the Scientific Advisory Team (see part 3 below).

Interactions between individuals at the same level in different programs and organizations (e.g., keepers at zoos and field personnel at release locations) are useful, as evidenced by the effectiveness of the Field Working Group. Our suggested reorganization includes holding semiannual meetings of the RIT and CRO, modeled on the current and productive "field team meetings," thereby formalizing the current Field Working Group as the Recovery Implementation Team. These meetings enable communication and interaction between isolated field workers, and participation of staff from California, Arizona, Baja California, and Oregon has been excellent. Certainly, this team may continue to be organized around release sites and captive populations, but we envision a much more dynamic formation of subgroups as issues arise, perhaps in collaboration with the Scientific Advisory Team. As issues change, leadership would shift among team members, allowing those who best understand and can solve the problem to lead (Westrum 1994). For example, once the program gets beyond the lead issue, new groups will likely be needed to address land-use changes, human demographics, and new release sites. This structure is fundamentally different from the current organization-specific, fixed leadership positions.

(2) To reduce the chain of command between the regional director and the CRO, the condor recovery coordinator and research and monitoring coordinator would report directly to a deputy regional director or assistant regional director rather than being placed within the hierarchy of a field office. It matters less whether this director is in the NWR system or Ecological Services than that the director be in a regional office rather than in a field office, where the personalities and directives of additional supervisors must be navigated by the CRO on behalf of the condor. As pointed out above, to coordinate a species that crosses USFWS jurisdictional boundaries, spends considerable time on private (rather than refuge) land, and ranges across international borders requires access to the regional director in the lead office for the listed species (in this case, Sacramento). It might be effective to physically locate the CRO in a field rather than regional office in order to maintain contact between the condor recovery and research and monitoring coordinators and personnel working with condors in the field.

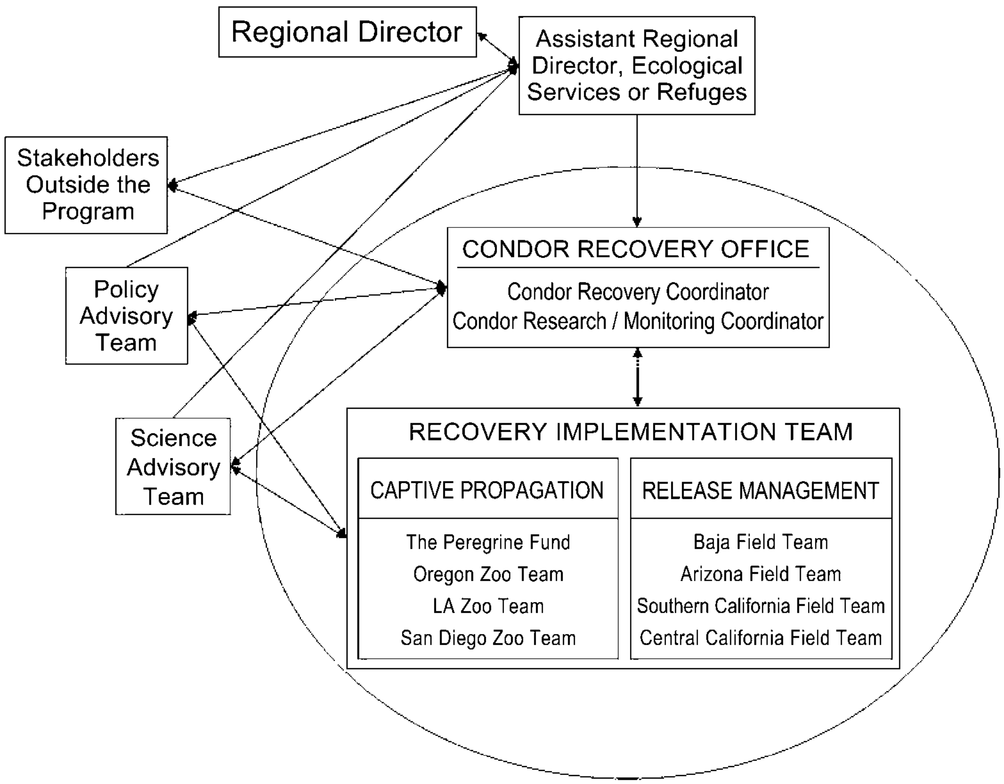

FIG. 10. Proposed reorganization of the California Condor Recovery Program. We suggest creating a new Condor Recovery Office, which would report directly to a U.S. Fish and Wildlife Service regional office, and an independent Science Advisory Team. The science team's autonomy would be enhanced by the creation of a separate Policy Advisory Team and a practical Recovery Implementation Team.

(3) The function and composition of the Recovery Team needs to be reconsidered. Our suggested reorganization involves disbanding the current team and dividing its duties between two new entities. The first is a small, scientifically focused advisory team. This Science Advisory Team (Fig. 10) would comprise 7 to 10 scientists with appropriate expertise (e.g., avian ecology and conservation, captive management, conservation genetics, contaminants, analysis of animal movements) and excellent interpersonal skills from a variety of institutions (academic, private, and governmental). Team members would interact with the CRO and RIT at biannual meetings, provide an objective scientific framework for the recovery process, review research results, and reassess future research needs. This group would take on some of the responsibilities of the current Recovery Team and associated research working group but would differ in having greater involvement of scientists outside the program. Independent advisory teams are increasingly common and effective (Stoskopf et al. 2005) as recovery teams transition from planning to implementation. The team would have clear rules and expectations that encourage creativity rather than suppression of novel ideas (Stoskopf et al. 2005), and team members would be independent of financial ties to condor recovery. The team might strive to prioritize short-term activities (tasks) or long-term activities (projects) and encourage publication of results at each meeting (Stoskopf et al. 2005). Working groups, led by team members and involving other scientists and managers within and outside the RIT, might be effective in addressing specific issues (e.g., lead poisoning, captive breeding, survival of released birds, land-cover change, veterinary care). By listening carefully to the CRO and RIT and applying broad scientific thought, priorities needed by the recovery program would be arrived at by consensus and conveyed to the USFWS regional director by the team. These priorities would include research rather than focusing exclusively on management.

(4) Leaders of organizations that are involved in the condor recovery effort would not be part of the Scientific Advisory Team, but their insights into program management and involvement in recovery implementation are critical to success. Therefore, we include in our suggested reorganization a Policy Advisory Team (Fig. 10), consisting of these participants and the condor recovery coordinator, that would meet as needed to set policy direction for the program and help coordinate communication and management among the various cooperating organizations. The Policy Advisory Team would furnish the partner organizations with a vehicle for providing input on important decisions that affect them, such as addition of new release sites, captive-breeding facilities, and partners and major shifts in program direction. Team members, and especially the leader (e.g., a CEO of an involved nongovernmental organization), would be expected to be visible, dynamic, technically savvy, high-energy, hands-on managers who ask key questions of the program and effectively voice the needs of the condor to the political world that ultimately will decide its fate.

The Role of Research and Science in the Condor Program

Ideally, endangered species programs should integrate management, monitoring, and research in an adaptive management framework, making research a component of the management mission (Walters and Holling 1990, Gosselin 2009). The adaptive management process developed for the ongoing Everglades restoration provides an excellent example of this process (National Research Council 2003, 2007; RECOVER 2006). Although there is effective feedback between monitoring and management in the condor program, for example in managing condor behavior, an adaptive management framework that includes research is not evident. Research occurs, but it is not coordinated and integrated into program operations as management and monitoring are. This hinders progress in understanding condor biology and addressing critical research and management needs. We believe that including a research and monitoring coordinator and Science Advisory Team (Fig. 10) will result in more effective use of research in the condor program.

Inside and outside the condor program, there is widespread concern that the role of research is insufficient and widespread support for making more use of a hypothesis-testing approach to research. Many partners perceive that the current condor program is run as a management and monitoring operation, and explicitly not as a research operation. Funding for research is extremely limited, and currently relatively little research is being conducted on free-living condors. There is a research working group associated with the Recovery Team, but no organized research structure to coordinate and take advantage of the research opportunities and data streams emerging from the operations of the program. The program could benefit from more involvement of U.S. Geological Survey (USGS) scientists, whose mission includes research in support of USFWS programs, as well as more involvement of the academic and zoo research communities. The recently formed Pacific Northwest California Condor Scientific Working Group—a consortium of USGS, USFWS, USFS, Oregon State University, and Oregon Zoo researchers who have outlined and prioritized research needs to evaluate the possibility that condors can be released back into the Pacific Northwest—illustrates the integration of research into the program that we recommend. The Santa Barbara Zoo, as a new partner, is an excellent resource for increasing the role of science in the program as well.

Behavioral issues, including the microtrash problem, are particularly well suited to an adaptive management approach. Active adaptive management involving experimentation provides the greatest opportunities for learning, but even a passive approach that formally relates management and monitoring to key questions would be far superior to the current situation. Data collected on free-living and captive birds need to be question-oriented (Meretsky et al. 2000). For example, the microtrash issue has not been addressed in a systematic way, yet it could be approached via a series of food-preference experiments involving microtrash-aversion conditioning of captive birds before their release. Examining food preference and nutritional value of domestic versus wild carcasses would be a simple yet critical experiment to conduct on free-living and captive birds. We recommend adoption of a formal adaptive management process that includes research to address these and other issues, in which hypotheses about the outcome of management actions based on current understanding of biology are stated explicitly and collection of monitoring data is designed to test these hypotheses.

Standardization and Management of Data

Considerable concern about standardization, management, and ownership of data exists throughout the condor recovery program. These issues encompass a wide array of topics, including access to historical records, responses to requests for data from individuals outside the program, dispersed storage of information, incomplete inventories of samples and specimens, absence of summary reports, delayed access to GPS movement data, incomplete information concerning law enforcement actions, and a general lack of standardization (e.g., multiple IDs for the same bird and multiple reporting formats). Personnel at one site do not always have access to the latest information from another and, as a result, sometimes repeat mistakes made elsewhere or fail to make use of new understanding of biology or management. The task of assembling all data relevant to a particular question, collected and stored in various, nonstandardized ways by the various partners, is sufficiently daunting to seriously impede research. Even Ventana and the National Park Service, though managing the central California birds as a single flock, are unable to merge much of their data. Some databases that would be extremely valuable (e.g., reproductive performance of individual breeding pairs, and blood lead levels recorded in free-living birds at each recapture) simply do not exist or are incomplete and have not been systematically examined.

That data-management concerns exist is not surprising given the long history of the recovery program; its expansion to include multiple reintroduction sites, organizations, and individuals; and rapidly evolving technologies. We conclude, however, that these problems have reached the point that they seriously impede the effectiveness of the program. Furthermore, there is a great deal of information gathered on condors over the years that needs to be reviewed and organized. As an interim measure, we recommend hiring a data manager–statistician to work with the proposed research and monitoring coordinator to oversee the existing data and assist in future standardization of data collection, reporting, and storage. Although postdoctoral researchers, students, interns, and volunteers should also be used in this effort, the data manager position needs secure funding to prevent turnover and provide consistency. Two important initial tasks for this position are to summarize the extant data for critical review and evaluation and to develop standardized databases for record keeping for all program participants.

Data management is a difficult but critical issue for long-term programs. Computerization is obviously required for effective management, but access to stored information can be hampered when computerized systems and programs become obsolete. Similarly, data stored in various programs or formats at multiple locations may not be readily accessible to program participants or other potential users. The condor recovery program clearly faces all these challenges. The zoos presently involved in the condor program maintain electronic information on each captive specimen using two independent database systems: (1) an Animal Records Keeping System (ARKS), which records information on location, behavior, molt, diet, breeding, transfers, etc.; and (2) a Medical Records Keeping System (MedARKS), which contains a record of all health-related issues, medical examinations, treatments, and so forth. Additionally, Mike Mace at the San Diego Wild Animal Park maintains the condor studbook (Mace 2007) using a third database program called Species Animal Records Keeping System (SPARKS), which contains an inventory of all living and dead condors and can be used to complete basic demographic and genetic analyses of the living population. Unfortunately, all these systems must be independently maintained and accessed, which impedes the timely sharing of information. The International Species Inventory System (ISIS) is presently developing a unified global database system called the Zoological Information Management System (ZIMS), which will combine the independent functions of the ARKS, MedARKS, and SPARKS systems (see Acknowledgments). This flexible, web-based system will use high-quality code and will allow authorized institutions to enter, search, and retrieve data directly. We recommend that participants in the condor program follow the development, testing, and deployment of the ZIMS system closely, because the benefits of applying this system to store, manage, and access information on captive and free-living condors are potentially huge.

Data ownership is a serious issue because it is not clear who owns collected data, research samples, or specimens. This situation has precipitated unnecessary conflict in the past and, unless effectively addressed, will continue to inhibit cooperation among partners and across release areas and captive-breeding facilities. Being derived from a federally organized endangered species program, data pertaining to the condor belong in the public domain. We encourage program partners to make more data more available and more accessible to others in the program and to the public at large. Internally, data should be shared freely among partners, while adhering to standard courtesies and protocols with respect to publication and proprietary information. We believe addition of a research and monitoring coordinator and data manager to the program and standardization of data collection will facilitate cooperation and promote sharing of data and testing of ideas among partners.

Field, veterinary, and pathology protocols should be evaluated with standardization in mind, although we recognize the need for partners to retain flexibility as appropriate to each program. Current program reporting schemes should also be evaluated in order to secure standardized contents, formats, and submission frequencies among cooperators. Feedback loops also need to be examined to make certain that important findings are translated into appropriate research and management actions.

Monitoring Released Birds

It is critical to continue long-term demographic monitoring and evaluation of birds in the wild. Currently, intensive monitoring of released birds is essential to reduce mortality caused by lead poisoning and to detect and treat undesirable behavior. Once the lead issue is resolved, continued monitoring will be needed to track population dynamics and key aspects of biology such as foraging patterns and dispersal.

Several methods, such as photographic identification of individual condors (Snyder and Johnson 1985) and radiotelemetry (Meretsky and Snyder 1992), were developed and used successfully in the 1980s to monitor various aspects of wild condor demography, ecology, and movements (Snyder and Snyder 2000).

Fig. 11. California Condor with patagial tag and VHF transmitter. (Photograph by S. Haig, U.S. Geological Survey.)

There was no evidence in these early studies that radiotransmitters, their attachment, and associated trapping and handling contributed to condor mortality. Since then, radiotelemetry has become the most important and frequently used method for monitoring released condors, as summarized for specific sites by Mee and Hall (2007). All released condors are fitted with a VHF transmitter mounted on the patagium (Wallace et al. 1994) or, occasionally, on the tail (Hunt et al. 2007) and fitted with vinyl tags attached at the patagium (Fig. 11) for visual identification. Despite these standard attachment methods, some have suggested that better methods for attaching or implanting transmitters should be explored, given that transmitters have caused injury to some birds. Some condors also receive GPS satellite-reporting transmitters designed to provide hourly position fixes with an accuracy of 50 m during daylight hours. Most tracking of VHF radiotagged condors is done by observers in motor vehicles or on foot at various high points, but fixed-wing aircraft are sometimes used to search for missing birds. Both GPS and VHF transmitters are needed to collect the data required for the monitoring program. Thus, we see great benefit in ensuring that each bird has one of each transmitter type. GPS transmitters will become increasingly important as the need to monitor foraging movements and dispersal increases. We recognize that funding issues may limit the use of GPS transmitters. However, managers should be able to do better than 5-month transmitter life, considering the technology now available.

Monitoring individual condors with radiotelemetry is essential for evaluating the success of releases, determining survival rates and range use, identifying sources of mortality, and alerting managers to situations that require active intervention or management changes. In addition, scientifically designed monitoring programs based on telemetry are required to identify reasons for failure or success of releases so that future releases can correct problems of the past and replicate successful releases. Currently, monitoring of released condors is required to reduce mortality from lead poisoning because it indicates where (geographic locations), when (season), and from which food sources condors are obtaining lead at various release sites (Hall et al. 2007, Hunt et al. 2007, Sorenson and Burnett 2007) and can identify birds weakened by lead poisoning (Mee and Snyder 2007). For example, monitoring has indicated that the relatively low incidence of lead poisoning in Big Sur condors is associated with their reliance on marine mammals, which limits their exposure to lead (Sorenson and Burnett 2007).

Monitoring is also required to detect undesirable behavior of released condors to determine underlying causes so that corrective actions can be taken. For instance, the effectiveness of different captive-rearing methods (e.g., puppet-rearing and parent-rearing) in reducing or eliminating unnatural tameness or attraction to humans and human structures can be evaluated only by close monitoring of released birds (Clark et al. 2007, Mee and Snyder 2007, Wallace et al. 2007). Monitoring of parental movements has identified some sources of microtrash delivered to nestlings (Grantham 2007, Mee et al. 2007a), which has led to cleaning efforts at these sources (Mee et al. 2007b, J. Grantham pers. comm.). Further reductions in power-line mortalities or injuries may be possible by sharing condor movement data and coordinating with the electric utility companies. In central California, the Ventana Wildlife Society is working with the electric company PG&E to modify lines by making them more visible (e.g., insulated lines and diverters) or even relocating them to eliminate condor accidents.

There are more radiotagged condors now than in the free-living population of the past, so that more and better data are accumulating on mortality factors (Hall et al. 2007, Snyder 2007, Woods et al. 2007). Identification of mortality factors was one of the justifications for initiating the early releases in the 1990s (Snyder and Snyder 2000). Nevertheless, the cause of mortality is unknown for about a third of the deaths since releases began (Snyder 2007). Improved monitoring has improved the ability to document mortality events, and increased use of VHF and GPS transmitters would result in further improvements. Future monitoring should also focus on tracking population dynamics and key aspects of biology such as foraging patterns and resource use (Marzluff et al. 2004) rather than functioning as a form of triage with respect to lead exposure and bird behavior. However, fully implementing these high-priority studies requires solving the lead problem. Costs will escalate as condor numbers grow; hence, sustaining the intense level of current monitoring may not be possible. Once the major stresses on condor populations that now exist have been ameliorated, some routine population-monitoring activities could be conducted by photographic identification of individual condors (Snyder and Johnson 1985). With the advent of digital photography, photographic identification of individuals has become more cost effective, and digital methods eliminate many of the earlier problems associated with film (e.g., Meretsky and Snyder 1992).

Monitoring of reproductive effort and success is also necessary to identify factors that contribute to reproductive failures so that ameliorative actions can be instituted, if needed, to ensure population stability or growth. Although successful breeding has occurred at all release sites except Baja California, the presence of breeding trios and divorce of breeding pairs at some sites interferes with reproductive success and may represent unnatural behaviors derived from captive-rearing methods, given that such behaviors were unknown in the original wild population (Snyder and Snyder 2000, Mee and Snyder 2007). Whatever the cause of this aberrant breeding behavior, monitoring is needed to determine whether the behaviors disappear with breeding experience or with changes in rearing methods as advocated by Mee and Snyder (2007). The intensity of monitoring and frequency of management intervention will vary among sites, depending on nesting success. For instance, at one extreme is intensive nest monitoring and frequent intervention in southern California to counter chick mortality caused by ingestion of microtrash and the threat of West Nile virus. This contrasts with Arizona, where nest success has been relatively high (45%), nest monitoring less intensive, and nest visits infrequent (Woods et al. 2007). These nest success rates at release sites can be combined with reproductive effort and survivorship data in demographic models (e.g., Meretsky et al. 2000) to indicate the likelihood of successful reestablishment of condors at a site.

Managing Population Structure

Although the genetic structure of the reintroduced populations is carefully managed (Mace 2007), the condor program lacks an overall vision of the geographic structure of a range-wide, self-sustaining population. Such a vision is needed to evaluate the efficacy of current and future release sites. Thus, some species-wide population modeling needs to take place in a risk-assessment venue so that various hypotheses regarding translocation and reintroduction may be evaluated with multiple stakeholder interests in mind. In essence, a detailed recovery target is needed, specifying locations of and movement rates between populations, demographic parameters, numbers and age structure of individuals within those populations, and sustainable and expected amounts of variation.

The existing release sites for condors represent remote locations in areas of appropriate habitat within the historical range. Initially, the birds released at different locations, tied to their nearby supplemental feeding sites, were effectively separate populations. As numbers grow and birds begin to forage more on their own and thus range more widely, the structure of the overall population becomes an important question. As noted above, managers quickly realized that the birds reintroduced at the two release sites in central California, Big Sur, and Pinnacles National Monument functioned as a single population and have adjusted their management accordingly. There have been interactions between the southern and central California populations as well, but on this larger scale there has not yet been an assessment of the birds' home range, dispersal tendencies, and potential links to release sites other than their own. Therefore, there is no plan for metapopulation development and conservation of the species at the range-wide level. However, detailed movement data, collected via attachment of various types of transmitters, have been collected at each release site and are currently being analyzed with the ultimate goal of providing perspective on how to better link existing populations and on where future reintroductions should occur to ensure healthy within- and among-population structure. Experience with the Eurasian Griffon Vulture illustrates the importance of having a network of populations (Le Gouar et al. 2008).

We recommend that the utility of current and future release sites be assessed on a metapopulation scale: the distribution of release sites should be based on desired geographic structure of a viable, self-sustaining range-wide population. Developing a range-wide plan to manage population structure and viability will involve evaluation of historical, current, and future habitat availability and connectivity. For example, establishment of breeding territories near release sites can necessitate identifying new release sites for existing populations. This was a factor in the decision to open a second release site in central California (i.e., Pinnacles). On a larger scale, it may be important to condor recovery to develop new release sites in the Pacific Northwest or elsewhere in order to increase asynchrony in environmental stochasticity among the component populations and thereby increase the stability of the overall metapopulation. It may become necessary to develop a more formal process for making such decisions as the program grows and the stakes (i.e., revenue for partners) become greater.

Until the lead problem is resolved, we cannot recommend opening additional release sites. If any new sites are opened in areas where lead ammunition is used, the birds will have to be induced to use supplemental food, monitored intensively for evidence of undesirable behavior and lead exposure, and regularly trapped and treated for lead poisoning, as they are elsewhere. However, once the lead issue is resolved, additional release sites should be considered. Currently, condors are not dispersing into their historical range in the southern Sierra Nevada from the southern California release sites. A Sierra release site previously identified as a good geographic location was rejected because of excessive lead exposure. With the new lead regulations in California and the recent setting aside of habitat on the Tejon Ranch that links the foraging habitat where the birds are now and the historical foraging areas in the Sierras, this and possibly other sites in the Sierras may become prime locations for a new release site. We suggest that a site in California's Sierra Nevada be considered as an alternative or additional release site for southern California. However, candidate release sites in the Sierras are distant from abundant nest sites. Perhaps the best goal for these sites is to resolve the lead issue expediently so that the four remaining condors originally captured from the wild in this region could be released there. Additional disjunct sites should be considered as appropriate.

The ability of condors released at Big Sur to locate and feed on marine mammals provides optimism about the viability of additional coastal release sites in similar habitat in northern California and Oregon, once the lead issue is resolved. However, the contaminant load in these carcasses must be evaluated before sites are selected, because marine mammals are known to bioaccumulate toxins that could be passed on to condors (see above).

Successful expansion of the range of condors may benefit from formal protection of future release sites and associated habitat. This provides incentive to identify future sites now, even if none will be opened soon. Development is occurring at a rapid pace, and the longer it takes to identify and protect potential future release sites and foraging areas, the fewer locations with sufficient, well-connected habitat will be available. Large parcels of land associated with current release sites have been protected, which indicates that it is possible (although difficult) to protect habitat for new release sites. The USFS, BLM, USFWS, and a number of tribal groups will likely be important partners in such efforts. In northern California, the Yurok Tribe is negotiating with Green Diamond Timber Company (formerly Simpson Timber) to purchase 40,000 acres near the Oregon border as a tribal park where condors could be released. This property would link inland forests (and food sources such as elk and deer) with coastal areas, thus providing a foraging corridor for condors. The tribe is hoping that habitat can also be secured close to their tribal park on the Oregon side of the border to provide a wider swath of habitat and better protection for the birds. The Yurok Tribe recently received funds from the tribal wildlife program of USFWS to carry out a prerelease assessment of habitat needs, food availability, potential lead exposure, and stakeholder interests within the Yurok ancestral territory. A Bureau of Indian Affairs interagency task force and the Tribal Park Task Force will help guide this effort.

Farther north, in Portland, the Oregon Zoo is interested in participating in a future release of condors in Oregon. To that end, historical records of condors in the state have been evaluated, current potential habitat has been documented, and modeling work to determine optimal release sites has been conducted. As described previously, the Pacific Northwest California Condor Scientific Working Group is assessing research to be undertaken prior to release of birds in Oregon.

Disease and Health Management

Effective procedures have been developed for monitoring and managing the health of condors in captivity and in the wild, and veterinarians within the program have prepared written protocols for managing health. Monitoring and treatment of birds for lead exposure has been especially impressive, albeit expensive and laborious. Each zoo maintains a dedicated staff for condor health. The Peregrine Fund utilizes a local veterinarian in Boise as well as long-term relationships with veterinarians at Washington State University and the Phoenix Zoo. Field teams have contracts with veterinarians and clinical diagnostic laboratories to monitor health and analyze blood samples for lead and clinical chemistry parameters.

Pathologists at the San Diego Zoo have prepared written protocols for the handling, shipment, and evaluation of dead condors for program participants. Although detailed pathology reports are available for most condors that have died in captivity or in the wild, we discern two gaps in information. The first involves dead condors that have been seized by USFWS Law Enforcement personnel as part of ongoing criminal investigations. The second involves examination of unhatched eggs of both captive and wild origin. These deficits in information need to be corrected. We recommend that the pathology coordinator develop a standardized protocol for submission and evaluation of all unhatched eggs. We also suggest close coordination between USFWS Law Enforcement and the pathologists at the San Diego Zoo to ensure consistency in all aspects of postmortem analyses, including histological examinations and tissue collections. Veterinary and pathology protocols should be reviewed, appropriately revised, and distributed to all program participants annually.

Condors have shown good resilience in captivity and do not have many health problems in the captive environment. In the wild, one free-flying Arizona juvenile and one California chick suffered broken wings, which were repaired. Both birds were eventually returned to the wild. Two chicks that suffered from trash impaction were taken from nests, treated surgically to remove the trash, and replaced in the nest the following day. Both ultimately fledged successfully. Few health problems other than lead poisoning and West Nile virus have plagued the program.

We recommend continuing the existing veterinary coordinator position to facilitate information transfer on topics such as vaccines and procedures. The Field Working Group meetings have assisted greatly in this information exchange and should be continued as well, reformed as the Recovery Implementation Team (see above). Addition of a research and monitoring coordinator and data manager to the program will make the veterinary coordinator more effective. We also recommend that the veterinary coordinator oversee development of general health protocols for the program. These should be carefully reviewed by participating veterinary representatives and updated appropriately.

West Nile virus.—The condor program appointed Dr. Cynthia Stringfield, then a veterinarian at the Los Angeles Zoo, to coordinate the vaccination program for West Nile virus when this threat hit bird populations on the East Coast in 1999. Dr. Stringfield worked with the Centers for Disease Control to identify the best vaccine to use for condors and other zoo birds (Chang et al. 2007). All captive condors have been vaccinated for West Nile virus, and protocols are in place to vaccinate all free-living chicks before 30 days after hatching and to administer a booster before fledging. The effectiveness of the vaccine has been demonstrated by complete protection of the captive flock. The only condors that have succumbed to West Nile virus were seven birds, including four chicks, at The Peregrine Fund's facility in Boise that were not vaccinated. Other birds at the facility became ill, but they recovered. Since that event in 2006, all adults and new chicks have been vaccinated at all facilities and all chicks have been vaccinated in accessible nests or when first captured in the wild. One free-living chick died in August 2005 in southern California before being vaccinated, which indicates that parentally transferred immunity will not protect a chick for long and that chicks must be vaccinated as early as possible.

Other threats.—The potential for high-pathogenicity avian influenza (HP H5N1) in condors could be significant if the avian flu virus gets imported into the United States and infects wild birds and poultry. Vaccines have been produced to immunize avian populations, especially captive zoo collections and endangered species such as condors. The vaccine protocols are managed by the U.S. Department of Agriculture and require federal permits to be employed. To date, no poultry or zoo birds have been vaccinated in the United States, and no vaccinations are planned unless H5N1 enters the country. More information on avian influenza can be found online (see Acknowledgments).

Outreach

Overall, most Americans consider the California Condor Recovery Program to be a success, rather than a work in progress. The public needs to be apprised of the reality of the situation, so that the resources essential for recovery can be secured. Effective outreach builds public support for returning the birds to the wild and helps partners raise the funds that they need to continue their contributions to condor recovery. Toward those ends, all major partners in the condor program are involved in outreach programs that educate the public about condors and highlight issues of concern such as littering (i.e., microtrash) and use of lead ammunition. These programs have produced materials ranging from informational websites to children's craft projects (for examples, see Acknowledgments). Although all partners are active in outreach, at least locally, they look to the USFWS for assistance and leadership at the national level. Currently, USFWS outreach activities are limited. If the USFWS is to provide effective leadership in outreach activities, this situation must be corrected, and indeed the USFWS is seeking to fill a staff position dedicated to outreach. It will also be important to engage the Santa Barbara Zoo in program-wide outreach activities, as this new partner has considerable capability and is willing to commit to a major role in outreach activities.

The prime example of where a national outreach program is needed is the lead issue. In our opinion, condor recovery is unlikely unless hunters adopt nonlead ammunition universally, and, therefore, gaining the support of the hunting community for such a change and increasing the appreciation within that community of their important role as providers of food for condors are key steps toward recovery. Those involved in the hunting industry must take the necessary steps to make nonlead ammunition widely and readily available as well. An important step toward rallying public support for replacement of lead ammunition was taken with The Peregrine Fund's 2008 conference on "Ingestion of Spent Lead Ammunition: Implications for Humans and Wildlife" (see Acknowledgments; Watson et al. 2009).

The Arizona Department of Game and Fish outreach program has been highly successful in illustrating the negative effects of lead ammunition and convincing hunters to use copper bullets for deer and elk hunting (Sieg et al. 2009). We recommend that state wildlife agencies in California and Utah, as well as in states such as Oregon where condors may exist in the future, participate actively in outreach and encourage hunting with nontoxic ammunition using programs similar to those in Arizona. Subsidies to hunters for nontoxic ammunition could be implemented in each state. Currently, the Cooperative North American Shotgun Education Program in Klamath Falls, Oregon, is promoting use of nonlead ammunition and investigating requirements for nonlead ammunition in various states.

A Look to the Future

The goal of the condor program is to establish a wild population that can maintain itself with minimal human intervention. If that goal is achieved, the zoos, veterinarians, and release-site field crews, and most of the current partners, would happily leave the condor business. The intense management, food subsidies, and triage activities of today would, hopefully, become a thing of the past. In fact, many of the partners have acknowledged that this is indeed their long-term vision. That vision may be a while in arriving.

In our opinion, the primary focus today must be on solving the lead problem, and secondarily the microtrash problem, as currently these are impenetrable barriers between the heavily subsidized populations of today and the self-sustaining populations envisioned for the future (Fig. 12). If these problems are solved, in the heady aftermath of that event it will be easy to be overly optimistic and imagine that recovery is imminent. But once past the current barriers, the condors will likely discover new, though probably less formidable, ones. Wind energy and gas and oil development loom as future threats. Emerging diseases and global climate change are other possible future issues. The genetic and

Fig. 12. Hopefully, these heavily managed birds of today will become the self-sustaining population of tomorrow. (Photograph courtesy of U.S. Fish and Wildlife Service.)

demographic stability of the captive and free-living populations may be another. Still, our review of the condor program leaves us optimistic. We believe that recovery of the condor, once almost inconceivable, is possible. Perhaps that is the greatest achievement of the condor recovery program over the past 25 years: to demonstrate the possibility of recovery. But this potential cannot be realized until the lead problem is solved.

Some will disagree with our assessment. There are many skeptics who believe that the landscape has changed so much that it can no longer support condors. Certainly, habitat has changed greatly and many formerly remote areas are now heavily affected by anthropogenic influences. The mammal community that was the basis of the condor food supply has changed greatly, as has the community of scavengers in which they compete, the addition of feral hogs being a particularly worrisome change in the latter. It is because of this that it will be critical to encourage and maintain hunting and controlled depredation shooting throughout the condor range, using nontoxic ammunition, to provide a source of food for the free-living birds. There are still wild places that appear to be able to support condors, and interest among many in expanding the free-living population. We believe that adaptive management provides the means to address whatever new issues arise and that there is great hope for recovery of these magnificent creatures.

Conclusions and Recommendations

In the following section, we provide a summary of the present review for the convenience of the reader, in the form of our most important conclusions and recommendations. All of these are presented in the body of the paper above, along with their respective bases.

The condor has long been symbolic of avian conservation in the United States. Following their extirpation from the wild in 1987, many questioned whether condors could ever be returned to the natural environment. Yet the California Condor Recovery Program, one of the oldest and most complex efforts of its kind in the United States, has achieved success beyond what many imagined possible. As of the summer of 2009, there were more than 350 condors, more than 180 of which were free-living, soaring in the skies of southern and central California, Arizona, Utah, and Baja California, Mexico. The free-living birds face severe challenges, however, and receive constant and costly human assistance. Thus, the program has reached a crossroads, caught between the financial and logistical pressures required to maintain an increasing number of condors in the wild and environmental problems that preclude establishment of wild populations that can sustain themselves without human intervention.

Recognizing this, Audubon California requested that the AOU conduct an evaluation of the recovery program. The AOU agreed to establish a Blue Ribbon Panel, consisting of the authors of the present review, as a subcommittee of their Committee on Conservation. We collected information through site visits to captive-breeding facilities and release sites, a review of the literature, interviews in person and by telephone of those involved in the condor program, and solicitation of comments from other interested parties. The following are our primary conclusions and recommendations.

Conclusion 1

Because the condor is a long-lived species with a low reproductive rate, annual mortality rates of adults certainly must be <10%, and likely <5%, for populations to be self-sustaining. We conclude that condors are exposed to lead through ingestion of ammunition fragments frequently enough that, were the birds not treated, mortality rates would rise above those required for sustainability. The evidence on this point is overwhelming and includes radiographs of lead fragments in sick condors and the carcasses on which they feed, direct linkages of illnesses and deaths to feeding on contaminated carcasses, and direct measurements of blood levels that indicated acute lead exposure in an alarming number of condors. In our opinion, progress toward recovery is not sustainable under current conditions because reintroduction of more condors simply increases the costs required to keep free-living birds alive rather than improving the ability of the free-living population to maintain itself. We concur with nearly all of those involved in the condor program that condor recovery will not be possible until exposure to lead in their food sources is totally eliminated. Replacement of lead with nonlead ammunition needs to be achieved on an ecologically relevant scale and thereby positively affect survival rates over all or a significant portion of the condor's range if self-sustainability in the absence of human intervention is to be achieved. We are skeptical that, even with excellent compliance, voluntary programs promoting the use of nonlead ammunition can achieve this goal. Similarly, the efficacy of area-specific requirements for nonlead ammunition, such as the local regulations on the Tejon Ranch or even the state regulations in California, remains uncertain when some legal uses of lead ammunition are retained in those areas. The effectiveness of voluntary programs and regulations targeted toward particular types of ammunition in particular areas in eliminating exposure of condors to lead will soon become apparent. If such partial regulation proves insufficient, some will likely suggest a national ban on lead ammunition, similar to the ban on lead shot for waterfowl hunting.

Recommendation.—The USFWS is the agency responsible for achieving recovery, including resolving the lead issue. However, neither the USFWS nor any of the other federal recovery partners have the statutory authority to regulate the use of lead ammunition outside of their lands. Thus, their role might be to make the case for eliminating lead ammunition to those agencies that have such authority and to the public in the context of promoting condor recovery. Coordination among land-management and regulatory agencies could provide a means of addressing lead exposure of condors over a meaningful spatial scale. State wildlife agencies are critical because of their jurisdiction over hunting regulations. We recognize that replacement of lead ammunition with nonlead alternatives will take some time and that a gradual transition will impose fewer hardships on hunters, state wildlife agencies attempting to implement new regulations, and ammunition manufacturers and distributors. In the meantime, we recommend that portable X-ray equipment be provided to all field crews to facilitate lead monitoring until a successful transition to nonlead ammunition is accomplished.

Conclusion 2

A reduction in hunting, depredation permits, or other types of shooting would not promote condor recovery. Such actions might effectively reduce lead in the environment, but they would also result in a significant reduction in the condors' food supply. Humans are the dominant predators in most of the condor's range, and carcasses and gut piles that result from hunting and other types of shooting are important food sources for condors. It is essential that hunters continue to harvest deer, pigs, and other wildlife throughout the condor range using nonlead ammunition, so that a clean source of wild food is available to condors beyond food subsidies. It is unlikely that condors could be sustained in the wild after food subsidies are reduced without this source of food. The lead-ammunition issue goes well beyond condors, affecting other terrestrial scavengers and potentially even human health.

Recommendation.—Hunters should be made aware of the importance of hunting to condors in order to gain their support for conversion from lead to nonlead ammunition. Hunters should also be made aware of the potential adverse effects of lead exposure from spent ammunition on other species, including humans.

Conclusion 3

Condors are provided with supplemental food at fixed sites to reduce their exposure to lead while foraging on their own and to enable managers to trap, test, and treat the birds for lead exposure. Although its effectiveness in achieving the objective of reducing lead exposure is arguable, luring captive-reared condors to feeding stations has clearly been invaluable for flock management. However, use of food subsidies likely retards development of normal wide-ranging foraging behavior, alters time and energy budgets, and may adversely affect other natural behaviors. Because of the widespread use of supplemental feeding, it is not yet clear whether condors could subsist without subsidies in modern landscapes, and this could become the next impediment to recovery beyond lead.

Recommendation.—Supplemental feeding must continue until the lead problem is solved, but we endorse efforts to encourage the birds to forage more widely by use of multiple feeding sites at strategic locations. We recommend further research to ascertain the capacity of condors to become self-sufficient foragers within the landscapes where they are being released.

Conclusion 4

Many in the condor program believe that supplemental feeding promotes development of undesirable behavior involving attraction to humans and human-built structures because it provides birds with more time for activities other than foraging. This is debatable, whereas it is quite clear that captive-rearing and socialization techniques affect the expression of undesirable postrelease behavior. Considerable progress has been made in refining these techniques to produce desired behavior, such that undesirable behavior is no longer an impediment to reestablishment of wild condor populations. Adult mentors and interaction with free-living condors at release sites prior to release have been especially positive innovations. That parent-rearing is more effective than puppet-rearing in bringing about more desirable juvenile and subadult behavior is a widely held belief, but evidence on this point is equivocal and could be further researched.

Recommendation.—We recommend continued emphasis on parent-rearing while demand for birds for release remains relatively low, on the premise that reducing reliance on humans is desirable. However, because puppet-rearing increases the productivity of breeding pairs, development of that technique should continue in order to satisfy increased demand for birds for release once the lead problem is solved. The close integration between captive-breeding and field facilities in managing behavior should continue. We also recommend attempting to improve rearing and release techniques further by making them more closely resemble natural processes of rearing and socialization.

Conclusion 5

The most significant behavioral problem at present is adults feeding small items of trash to chicks in southern California, which has significantly reduced breeding success there but has not been a major issue elsewhere. We conclude that currently, given the microtrash problem, successful nesting in southern California is contingent upon intensive nest monitoring and corrective intervention as needed. The causes of this behavior are not yet understood. We suggest that the most promising avenues to pursue in reducing this problem are (1) eliminating mictrotrash at sites frequented by condors; (2) returning adults that exhibit such behavior to captivity for aversive training, as has been done for other undesirable behaviors; and (3) promoting more natural foraging patterns in nesting adults. Although recent data suggest that this last avenue may not reduce the frequency of feeding of microtrash by breeders with a tradition of such behavior, current foraging patterns still fall far short of those documented historically.

Recommendation.—Ongoing efforts to document and clean up microtrash sites need to be continued. We recommend that experiments with aversive training involving young birds prior to their release and adults that have exhibited feeding of microtrash in the wild be undertaken in captivity as soon as practicable. Additional experiments designed to increase parental foraging time and effort should be undertaken as soon as lead risks can be minimized and addressed. Additional research into the cause of such behavior should be conducted.

Conclusion 6

That condors readily feed on marine mammals in central California is a positive development, but it is critical to make sure that there are no deleterious issues associated with this food source. Of particular concern are the possibilities of eggshell thinning caused by exposure to DDE and long-term health effects associated with other toxicants, such as PCBs.

Recommendation.—We recommend vigorous and timely investigation of the possibility that contaminants acquired by feeding on marine mammals interfere with condor reproduction. Specialized protocols need to be developed for collection of eggs and tissues of condors in central California in order to assess and monitor contaminants. Testing of samples and analyses of results must be completed in a timely manner.

Conclusion 7

The condor program includes federal, state, and private partners that collectively expend more than $5 million annually. The major partners are the USFWS, National Park Service, Los Angeles Zoo, San Diego Wild Animal Park, Oregon Zoo, The Peregrine Fund, Ventana Wildlife Society, and Arizona Department of Game and Fish. These partners have developed an effective captive-breeding and release program that has produced impressive results and, through valiant effort, are maintaining growing populations in the wild. Recovery partners are self-organized into a diffuse network, the central elements of which are a large and diverse Recovery Team, a Field Working Group, and a USFWS condor recovery coordinator. In our opinion, the current structure of the program reflects past rather than current or future conditions. Specifically, within the USFWS, the program is housed in a field office at the refuge associated with the site of the first releases of captive-bred condors in southern California, and the condor recovery coordinator reports to a project leader within that office. This unnecessarily increases the chain of command concerning condors, and today, the refuges associated with this office represent only a small fraction of the range of the southern California birds, whereas the coordinator needs to monitor and lead a large program that spans two countries and three USFWS regions. The overly large Recovery Team has too many responsibilities and has come to resemble a stakeholder group in being composed primarily of active participants in the condor rearing, release, and monitoring programs. There is relatively little input from independent scientists outside the program that could bring new vision to the recovery effort.

Recommendation.—We recommend that the structure of the program be overhauled to better reflect current and future circumstances. The one possible reorganization we have outlined as an example includes establishment of a Condor Recovery Office that works with a Recovery Implementation Team comprising those organizations that rear, release, and monitor condors. The Recovery Implementation Team is modeled after the current Field Working Group, which has been very successful. In our suggested reorganization, the Condor Recovery Office would report to a USFWS deputy regional director or an assistant regional director, and basic programmatic coordination would be the duty of the condor recovery coordinator. The Condor Recovery Office would include an additional senior-level USFWS or USGS staff scientist designated as condor research and monitoring coordinator. The proposed structure also includes a Science Advisory Team, a small, scientifically focused advisory group composed largely of independent scientists outside of the condor program. Leaders of organizations that are involved in the condor recovery effort would not be part of the Scientific Advisory Team, but their insights into program management and involvement in recovery implementation would be critical to success. These participants and the condor recovery coordinator would form a Policy Advisory Team. Under our proposed structure, the existing Recovery Team would be disbanded and its functions assumed by the Scientific Advisory and Policy Advisory teams.

Conclusion 8

Field staffing at the southern California release sites operated by the USFWS is insufficient. Although monitoring requirements there exceed those at other release sites because of the microtrash problem, many of these responsibilities fall to a small number of temporary employees. Elsewhere they are performed by a larger number of permanent staff.

Recommendation.—We recommend that additional funding be obtained from either the USFWS or program partners to adequately staff the southern California release sites.

Conclusion 9

Adaptive management requires an effective and continuous integration of research, monitoring, and management. Although there is effective feedback between monitoring and management in the condor program, for example in managing behavior, an adaptive management framework that includes research is not evident. Research occurs, but it is not coordinated and integrated into program operations as are management and monitoring. In our opinion, this hinders the ability to improve understanding of condor biology and address critical research and management needs.

Recommendation.—The condor program should be reorganized to enable more effective use of research. In our suggested reorganization, this is accomplished by the addition of a research and monitoring coordinator and formation of a Science Advisory Team. We further recommend adoption of a formal adaptive management process that includes research in addressing important issues in the condor program.

Conclusion 10

Considerable concern about standardization, management, and ownership of data exists throughout the condor recovery program. That data management concerns exist is not surprising given the long history of the recovery program, its expansion to include multiple reintroduction sites, organizations, and individuals, and rapidly evolving technologies. We conclude, however, that these problems have reached the point where they seriously impede the effectiveness of the program. Furthermore, there is a great deal of information gathered on condors over the years that needs to be reviewed and organized.

Recommendation.—We recommend hiring a data manager–statistician to oversee the existing data and assist in future standardization of data collection, reporting, and storage. In our suggested reorganization, the data manager would work with the research and monitoring coordinator. Two important initial tasks for this position are to summarize extant data for critical review and evaluation and to develop standardized databases for record keeping for all program participants. We encourage program partners to make more data more available and more accessible, both to others in the program and to the public at large.

Conclusion 11

Currently, intensive monitoring of released birds is essential to reduce mortality caused by lead poisoning and to detect and manage undesirable behavior. Once the lead problem is resolved, continued monitoring will be needed to track population dynamics and key aspects of biology such as foraging patterns and dispersal.

Recommendation.—We recommend that demographic monitoring and evaluation of the health and behavior of free-living birds be continued. As the birds range more widely, it will be increasingly important to integrate monitoring into the adaptive management framework to learn about emerging issues such as foraging capabilities, connections between populations, and contaminant levels. We also recommend that intensive nest monitoring be continued in southern California until the behavior of feeding microtrash to chicks is extinguished.

Conclusion 12

As the number of free-living condors grows and the birds begin to range more widely, the geographic structure of the overall population becomes an important question. Currently, there is no plan for metapopulation development and conservation of the species at the range-wide level.

Recommendation.—We recommend that the utility of current and future release sites be assessed on a metapopulation scale such that the distribution of release sites is based on the desired geographic structure of a range-wide population. We cannot recommend releasing condors at new sites at this time because of the lead issue; however, once this issue is resolved, additional release sites should be considered. We recommend that a site in California's Sierra Nevada be considered as an alternative to Bitter Creek NWR or an additional site in southern California. It may be important to develop new release sites in the Pacific Northwest or elsewhere in order to increase asynchrony in environmental stochasticity among the component populations and thereby increase the stability of the overall metapopulation.

Conclusion 13

Condors have proved adaptable to captivity and do not have many health problems in the captive environment. Effective procedures to monitor and manage the health of the birds in captivity and in the wild have been developed, and veterinarians within the program have prepared written protocols. Although thorough protocols for processing dead condors exist, there are two gaps in information: (1) dead condors that have been seized by USFWS Law Enforcement as part of ongoing criminal investigations and (2) examination of unhatched eggs.

Recommendation.—We recommend continuing the existing veterinary coordinator position to facilitate information transfer on topics such as vaccines and procedures. Addition of a research and monitoring coordinator and data manager would make the veterinary coordinator more effective. We also recommend that the veterinary coordinator oversee development of general health protocols for the program. We recommend that the pathology coordinator develop a standardized protocol for the submission and evaluation of all unhatched eggs of wild or captive origin, and closer coordination between USFWS Law Enforcement and the pathologists at the San Diego Zoo, to ensure consistency of postmortem analyses.

Conclusion 14

Effective outreach programs are a necessity for condor recovery. Program partners are active in outreach, but they look to the USFWS for assistance and leadership at the national level. There is an urgent need for an extensive outreach effort to rally public support for replacement of lead ammunition.

Recommendation.—Leadership in outreach at the national and state levels is necessary, especially with regard to the lead issue. Other states could participate more actively in outreach and encourage hunting with nontoxic ammunition using programs similar to those in Arizona. Subsidies to hunters for nontoxic ammunition could be implemented in each state. As already noted, most Americans consider the recovery program a success, rather than a work in progress, and the public needs to be apprised of the reality of the situation so that the resources essential for recovery can be secured.

Conclusion 15

Our review of the condor program leaves us optimistic. We believe that recovery of the condor, once almost inconceivable, is possible. Perhaps that is the greatest achievement of the condor recovery program over the past 25 years: to demonstrate the possibility of recovery. But this potential cannot be realized until the lead problem is solved.

Recommendation.—Resolve the lead issue and move forward.

Acknowledgments

We are grateful for the support and assistance of Audubon California at all stages of this review. This was truly a joint effort between the AOU and Audubon California. We especially thank G. Chisholm for his guidance throughout the process. We are also grateful for funding from the National Fish and Wildlife Foundation and the Morgan Family Foundation and other private donors, which provided the resources necessary to conduct a meaningful review. We would not have been able to fully understand the program without being able to visit the key sites where captive breeding, releases, and monitoring of free-living birds occur, and without being able to speak personally with those involved in all aspects of the program.

We thank all the participants in the condor program with whom we spoke or who otherwise provided us with information for being so generous with their time and experiences, and so candid in their assessments and suggestions. We had wonderfully informative and exciting experiences at all the sites we visited, thanks to the excellent planning and hospitality of program staff. Because of this, conducting this review has been a great pleasure for all of us. We especially thank the local hosts at the sites we visited: M. Mace at the San Diego Wild Animal Park, J. Grantham at the U.S. Fish and Wildlife Service Refuge Office in Ventana, S. Kasielke at the Los Angeles Zoo, D. Shepherdson at the Oregon Zoo, C. Parish in Arizona, B. Heinrich in Idaho, K. Sorenson at Big Sur, and J. Petterson at Pinnacles National Park.

We gathered information from many individuals in several ways, and to all these individuals we are grateful: C. Barr, M. Best, J. Brandt, J. Burnett, T. Cade, M. Clark, C. Cox, C. Davis, D. Elam, E. Feltes, A. Gaffrey, J. Grantham, L. Greer, J. Heartline, B. Heinrich, P. Henson, G. Hunt, C. Ing, D. Janssen, P. Jenny, R. Jurek, S. Kasielke, M. Koenig, M. Kolar, J. Lewis, E. Lorentzen, M. Mace, W. Mansell, K. McDermond, D. Moen, L. Oaks, C. Parish, J. Petterson, I. Plascencia, R. Posey, D. Remlinger, B. Rideout, B. Risebrough, C. Sandfort, E. Sandhaus, S. Scherbinski, D. Shepardson, K. Sorenson, S. St. Michael, D. Steele, D. Sterner, M. Stockton, K. Sullivan, R. Townsend, T. Vechio, M. Wallace, R. Watson, M. Weitzel, A. Welch, and J. Wynn provided information in personal interviews. J. Ballou, K. Day, D. Geivet, J. Grantham, L. Kiff, A. Mee, J. Parrish, K. Ralls, N. Snyder, B. Stine, C. Stringfield, and S. Thompson provided information during telephone interviews. D. Dasmann, S. Ferry, M. Moore, E. Peters, N. Sandburg, B. Sharp, D. Smith, and T. Supplee submitted written comments to us. C. Barr, D. Clendenen, J. Hamber, R. Jurek, L. Kiff, M. Mace, A. Mee, J. Petterson, N. Snyder, K. Sorenson, B. Toone, and M. Wallace provided information to B. Bernstein through telephone interviews in the preassessment phase of the project. In addition to these formal interviews and conversations, each of us individually met and spoke with many others in informal settings during various events at the sites we visited. We apologize for not being able to acknowledge all these individuals personally, and we assure each of them that their input was valued and has contributed meaningfully to our review.

Following the release of the report on which this review is based, we received comments from several individuals that were invaluable in revising the manuscript. For this assistance we thank J. Burnett, T. Cade, J. D'Elia, M. Fitzpatrick, M. Johnson, R. Jurek, R. Kirby, A. Lugo, M. Mace, C. Phillips, B. Risebrough, C. Schuler, J. M. Scott, N. Snyder, K. Sorenson, C. Stringfield, and two anonymous U.S. Geological Survey reviewers. We also received feedback on the report during telephone briefings with the U.S. Fish and Wildlife Service Regional Office in Sacramento, the National Fish and Wildlife Foundation, the Field Working Group, and California Fish and Game. We thank everyone involved in those conversations for their comments, which helped us in revising the material. We thank M. Morrison and two anonymous reviewers for comments on the manuscript.

Finally, the Panel wishes to express its appreciation for the multifaceted assistance of Karen Velas (of Audubon California) and Brock Bernstein. Brock's preassessment laid the foundation for our review, and he ably facilitated many of our interviews and edited the manuscript. Karen handled virtually all of the logistics associated with our work. Without Karen, the Panel would literally have been lost.

For information on the Zoological Information Management System, go to www.isis.org/Pages/default.aspx. Information on avian influenza is available from the University of Minnesota Center for Infectious Disease Research and Policy website at www.cidrap.umn.edu/cidrap/content/influenza/avianflu/biofacts/avflu.html#_Hosts or from the Wildlife Disease Information Node of National Biological Information Infrastructure at wildlifedisease.nbii.gov/diseasehome.jsp?disease=Avian%20Influenza&pagemode=submit. Examples of outreach programs by partners in the condor recovery effort can be found at www.sandiegozoo.org/animalbytes/t-condor.html, www.azgfd.gov/w_c/california_condor_lead.shtml, and www.sandiegozoo.org/kids/craft_condor.html. Information and proceedings from The Peregrine Fund's 2008 conference on "Ingestion of Spent Lead Ammunition: Implications for Humans and Wildlife" is at www.peregrinefund.org/lead_conference/default.htm.

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