BEFORE THE
FISH AND GAME COMMISSION
STATE OF CALIFORNIA

1416 Ninth Street
Sacramento, California 95814

In Re: Petition for Rulemaking To Address Lead Poisoning from Toxic Ammunition in California.	)	**Petition for Rulemaking Under The Administrative Procedure Act**
Center for Biological Diversity, Natural Resources Defense Council, Wishtoyo Foundation, Public Employees for Environmental Responsibility, Ventana Wilderness Alliance, Dave Clendenen, and Anthony Prieto ***Petitioners***	)	**Date: December 16, 2004**

PETITION FOR RULEMAKNG
UNDER ADMINISTRATIVE PROCEDURE ACT

Pursuant to the California Administrative Procedure Act, California Government Code § 11340.6, and for the reasons more fully described below, the Center for Biological Diversity, Natural Resources Defense Council, Wishtoyo Foundation, Public Employees for Environmental Responsibility, Ventana Wilderness Alliance, Dave Clendenen, and Anthony Prieto (Petitioners) hereby petition the California Fish and Game Commission to revise rules governing hunting to require the use of non-lead ammunition for all hunting within the State of California. Petitioners request immediate emergency action to require non-lead ammunition for hunting in the habitat of the California condor. Petitioners request that the Commission consider this emergency rulemaking pursuant to Cal. Gov. Code § 11346.1 and Cal. Fish and Game Code § 240 and place this request on the agenda for a discussion and action at the first Commission meeting for which it can be properly noticed.

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I. STANDING TO FILE

The Center for Biological Diversity (CBD) is an organization that seeks to protect and restore the endangered species and wild places of North America and the Pacific, including such resources within the State of California, through science, policy, education, citizen activism, and environmental law. CBD has over 11,000 members, many of whom reside in California. CBD maintains offices in San Francisco, Idyllwild, and San Diego to coordinate its efforts in California.

The Natural Resources Defense Council (NRDC) is a nationwide environmental advocacy organization that uses law, science and activism to protect the planet's wildlife and wild places and to ensure a safe and healthy environment for all living things. NRDC has over 1 million members and online activists, many of whom reside in California. NRDC has California offices in San Francisco and Los Angeles.

The Wishtoyo Foundation is a Native American organization in Ventura County that utilizes traditional Chumash cultural values and practices to foster environmental awareness. The Wishtoyo Foundation shares Chumash beliefs and values with the public to instill awareness and responsibility for sustaining the health of our land, air, and water for the benefit of future generations. The Chumash people have lived for centuries in the condor range along the California coast between Malibu and San Luis Obispo. As evidenced by condor pictographs, condor ceremonies, and condor dances the Chumash people have a long history of interaction with the California condor for a variety of purposes, including religious and ceremonial ones. The Chumash people and the Wishtoyo Foundation have a strong cultural interest in the recovery of the California condor.

Public Employees for Environmental Responsibility (PEER) is a 10,000 member national alliance of local, state and federal resource professionals working to protect the environment. PEER members include government scientists, land managers, environmental law enforcement agents, field specialists, and other resource professionals committed to responsible management of America’s public resources. PEER is based in Washington D. C. and maintains a California chapter office in Sacramento. California PEER, with 1,200 members, has the most members of any state chapter.

The Ventana Wilderness Alliance (VWA) is an all-volunteer grassroots organization dedicated to protecting the wilderness qualities and biodiversity of the public lands within California's northern Santa Lucia Mountains and Big Sur coast, the heart of the condor range in central California. A primary focus of the VWA is working with the agencies responsible for the management of these lands, including Los Padres National Forest and Fort Hunter Liggett.

David Clendenen is a hunter and the Preserve Manager of the 97,000 acre Wind Wolves Preserve in the southern San Joaquin Valley. Wind Wolves Preserve, managed by the Wildlands Conservancy, provides important condor foraging habitat and has been proposed by the U. S Fish and Wildlife Service as a release site for California condors. Mr. Clendenen hunts deer in California, and deer and elk in Wyoming.

Anthony Prieto is a lifetime hunter with over a decade of volunteer experience with the U. S. Fish and Wildlife Service's California Condor Recovery Program. He is a founder of Project Gutpile, a volunteer organization that educates hunters about the impact of lead ammunition on California's wildlife. Mr. Prieto hunts wild pig in California and has been promoting non-lead bullets and educating hunters for years in Santa Barbara and Ventura.

All of the petitioning organizations have members who visit California condor habitat, seek to view condors in the wild, and are concerned about risks to condors and impediments to their recovery from endangered status. Each of the petitioning organizations and petitioning individuals is "an interested person" under the California Administrative Procedure Act.

II. NATURE OF THE REQUESTED REGULATION

Petitioners seek revisions to current regulations found in Title 14 of the Code of California Regulations (CCR), to safeguard imperiled wildlife and human health and to promote the recovery of California condors. Petitioners request that the California Fish and Game Commission (Commission) adopt regulations requiring the use of non-lead[1] ammunition, including bullets and shot, for all hunting within the State of California. Petitioners request that regulations requiring the use of non-lead ammunition within California condor habitat be promulgated on an emergency basis pursuant to California Fish and Game Code § 240. Petitioners seek these regulations to protect vulnerable wildlife species, including the California condor (a federally listed endangered species and a state listed endangered and fully protected species), bald eagle (a federally listed threatened species and a state listed endangered and fully protected species), and golden eagle (a state species of special concern and fully protected species) from the ongoing threat of lead poisoning. Petitioners request that the Commission establish a public process for certifying lead-free ammunition to be required for all hunting in California. Available alternatives to conventional lead ammunition that do not pose lead or other significant toxicity risks to wildlife, particularly avian scavengers and other raptors, should be certified for use for hunting, subject to conditions that ensure they will not compromise the health of any wildlife species of concern, or adversely affect public health and safety or the environment.

In responding to this petition, we ask the Commission to remain mindful that hunting is a well-established, widely-practiced, and traditional activity in California. The timing and nature of ammunition restrictions and authorizations should be tailored to minimize transition issues and other adverse consequences for the State's hunters, to the maximum extent consistent with the Commission's obligation to protect threatened and endangered species and the factual record before it. More specifically, the petitioners request that the Commission, in formulating lead-free hunting regulations, carefully consider practicability factors such as the following: the availability of lead-free ammunition in caliber and shot types suitable for approved hunting of mammals and birds; the time required to notify and educate hunters and promote their compliance; the possible need for re-sighting guns or making other equipment adjustments; and the potential for reducing burdens on hunters through rebates and similar programs. At the same time, petitioners request that the Commission attend to the urgency of lead exposure risks to wildlife and human health, particularly to the highly endangered California condor.

[1] The use of the term "non-lead" or "lead free" throughout this petition is not intended to foreclose use of alternatives to conventional lead ammunition that the Commission finds, on the basis of the best available science, contains lead only in a form that does not cause toxic exposure to wildlife or human handlers of the ammunition.

III. REASON FOR THE REQUEST

Lead poisoning from lead ammunition is the single greatest threat to the health of California condors and is a significant threat to other imperiled wildlife species such as bald and golden eagles in California. Lead ammunition is the primary source of lead deposition in the wild and ingestion of lead from bullet fragments or lead shot in carrion is a significant source of lead exposure for condors and other avian scavengers. Lead ammunition also poses a human health risk, particularly to hunters who may handle or inhale lead from ammunition, to those who ingest meat from game tainted with lead ammunition fragments, and for people who reside near soils and waters contaminated by discarded lead ammunition. The failure to regulate the use of lead ammunition within the state is inconsistent with laws of the State of California and the United States that protect endangered or threatened species of wildlife, particularly for species which may suffer population level effects, such as the California condor, bald eagle, and golden eagle. Because lead ammunition causes ongoing serious impacts to the welfare of the highly imperiled California condor, the Commission should act pursuant to its emergency powers.

A. Introduction

Lead has long been identified as a highly toxic substance. Health effects from lead exposure can run the gamut from acute, paralytic poisoning and seizures to subtle, long-term mental impairment, miscarriage, and impotence. General prohibitions on the use of lead in media that affect human populations are widespread. We have eliminated lead from gasoline, prohibit its use in water supply systems, and are deeply invested in remediating its widespread occurrence in paint.

The metal remains, however, widely encountered and distributed in the environment in the form of lead ammunition. The continued preference of many hunters for traditional lead bullets and shot exposes any animal that preys or scavenges on targeted wildlife to lead's toxic effects. Particularly susceptible are avian species such as eagles and vultures, with 97% of bald eagles and 86% of golden eagles showing elevated blood levels of lead in one study (Harmata and Restani 1995). They encounter lead in carcasses left in the wild, in gut piles from animals cleaned in the wild, and in wounded prey species that survive hunting and carry lead ammunition in their bodies. Unequivocal evidence shows that California condors, bald and golden eagles and turkey vultures experience highly elevated blood lead levels as the result of ingesting ammunition. Numerous instances of individual bird mortalities associated with lead ammunition ingestion have been recorded.

Among these avian species, none is in such dire straits, and so plainly and urgently at risk from lead ammunition, as the California condor. Listed as endangered on federal and California endangered species lists and designated a "fully protected species" under California law, the condor is one of the world's most imperiled birds. Today, after an intensive captive breeding program, there are about 100 condors in the wild. The extraordinary, risky, and controversial strategy of bringing all then-remaining condors into a captive breeding program in 1985 was approved by both the Commission and the California Department of Fish and Game (CDFG) expressly because of the high risks the birds faced in the wild, particularly from lead poisoning.

As much progress as the condor recovery effort has made, the birds are being released back into an environment that is no more hospitable than it was when they were removed twenty years ago. Of the 67 condors released into the wild in Southern California from 1992 to 2002, fully 32 are dead or presumed dead (USFWS 2004a). Lead is now, or is rapidly becoming, the single greatest mortality factor for released condors. The California Condor Lead Exposure Reduction Steering Committee, a subcommittee of the U. S. Fish and Wildlife Service (USFWS) California Condor Recovery Team, concluded in a 2003 report that "lead poisoning is a demonstrable obstacle in the recovery of the California condor." This committee is made up of wildlife biologists, conservationists, and game managers, as well as hunting and gun advocates - a strikingly broad coalition of stakeholders. CDFG commissioned a recent study by University of California, Davis researchers that came to the same conclusions (Fry and Maurer 2003). With 35% of released condors experiencing acute lead poisoning by 2001 (Wiemeyer 1988; Risebrough et al. 2001), numerous researchers have concluded that reintroduction efforts cannot be expected to result in viable condor populations until sources of lead contamination in the environment are effectively addressed (Meretsky et al. 2000, 2001; Snyder and Snyder 2000; Beissinger 2001, 2002; Snyder and Schmidt 2002). Previous studies of reintroduction programs corroborate that unless the threats and limiting factors for a species are controlled or eliminated over biologically significant areas, there is a very high probability that the reintroduction will fail (see Griffith et al. 1990).

Human beings are also at risk from lead ammunition. Those who handle or hunt with lead are exposed to lead residues and airborne lead particles. Graver risks are faced by those who consume wildlife taken with lead ammunition, which can leave particles too fine to find and remove. Also at risk are people in communities where lead from shooting ranges and dumps accumulates up in soils and water near homes.

Fortunately, alternatives to the use of lead in bullets and in shot are now available, and some of them have superior performance characteristics to their lead counterparts. Switching to alternative ammunition does not entail the problems encountered when waterfowl hunters changed to steel shot years ago. Even without the presence at this time of a large market to drive down prices, purchase of alternative ammunitions represents a very small increase in the total price of a hunting trip, on the order of $15.

The Commission, through its authority to regulate all aspects of hunting in California, can directly and substantially reduce the adverse impacts of lead on the State's environment. The Commission has a clear, legal responsibility to halt the harmful exposure of California's protected and endangered species, including the condor and the bald and golden eagles, to the toxic effects of lead ammunition. The Commission has the opportunity to take the significant step of ending one of the last vestiges of our society's once widespread, unthinking, and disastrous use of a highly toxic compound in everyday materials and goods.

B. Toxic Effects of Lead Ammunition on Wildlife

While most efforts to abate lead contamination have focused on the metal's human health impacts, its toxicity to wildlife is firmly established. The role of ammunition as a primary vector for lead poisoning in many birds is similarly well-known. Thus, for instance, the USFWS, U. S. Geological Survey, and U. S. Environmental Protection Agency have determined that lead exposure from ammunition and tackle can be lethal to dozens of avian species (Sanderson and Bellrose 1986; USFWS 1986; USEPA 1994), with lead poisoning from ammunition being a particular threat to waterfowl and to birds of prey that scavenge upon waterfowl and other carrion left by hunters. Numerous studies have shown that lead exposure results when raptors consume metallic lead imbedded in the tissue or retained in the digestive tract of prey animals, rather than through consumption of tissue-bound lead bio-accumulated in their prey (Stendall 1980; Franson et al. 1983; Custer et al. 1984; Kramer and Redig 1997). Obligate scavengers such as condors and other vultures are particularly vulnerable to lead ingestion as long as hunter-shot carcasses containing lead ammunition are available in their foraging range.

The following sections detail known lead ammunition threats to several California raptors. Special attention is given to the California condor because of the more urgent threats to that species and the larger body of relevant scientific studies available for it. Petitioners focus on solid data that establish a strong connection between the use of lead ammunition and health impacts to raptors. In fact, however, the range of adverse effects is presumptively much wider than can readily be shown through direct observation. Non-lethal lead exposure can increase the susceptibility of wildlife to trauma, starvation, or disease. Long-term chronic exposure to sub-lethal levels of lead may affect vision, neuromuscular coordination, cardiac function, reproductive processes, or digestive processes, as it does in other organisms, including human beings (ATSDR 1999). Raptors with sublethal toxic lead exposure can become anorexic (Reiser and Temple 1981), have impaired vision and motor activity (Pattee et al. 1981), and be more susceptible to disease, capture, and collisions with vehicles (Scott and Eschmeyer 1980; Reiser and Temple 1981; Redig 1985).

1. **Bald Eagle** (*Haliaeetus leucocephalus*)

The bald eagle is federally listed as a threatened species and is state listed as an endangered species under the California Endangered Species Act (CESA) (Cal. Fish & Game Code (CFGC) §§2050-2116). The bald eagle is further listed as a Fully Protected species under the CESA, meaning it may not be taken or possessed at any time (CFGC § 5511).

Mortality associated with lead poisoning has often been recorded in bald eagles (Pattee et al. 1981; Redig et al. 1983; Reichel et al. 1984; Gill and Langelier 1994), and in virtually every case the source of lead was shot or other projectiles. A study of lead exposure in 27 bald eagles captured or collected dead in California and Oregon from 1979-1982 found that 41% of the captured eagles had exposure to lead and of the 10 dead eagles, 90% had sub-lethal poisoning and 10% had acute lead poisoning (Frenzel and Anthony 1989). Mortality of bald eagles from lead poisoning via bullets has also been recently documented in the Northern Rockies (Snyder and Snyder 2000).

Scientific concern over lead poisoning in wildlife originally stemmed from the relationship between bald eagles and waterfowl, since bald eagles often gather to scavenge un-retrieved carcasses, or prey on ducks that are crippled or carrying embedded shot in waterfowl hunting areas (Pattee and Hennes 1983). Indeed, the poisoning of bald eagles by lead shot was the impetus for the USFWS decision to ban the use of lead shot for waterfowl hunting in 1991 (USFWS 1986; 50 C.F.R. 20.21(j)). Bald eagles and other raptors that fed on lead shot embedded in waterfowl exhibited symptoms of acute and chronic lead poisoning.

While lead exposure in waterfowl appears to be declining dramatically as a result of the ban on lead shot for hunting waterfowl, bald eagles continue to show significant exposure to lead (Kramer and Redig 1996; Anderson et al. 2000), likely from alternative lead sources, as waterfowl only comprise a portion of bald eagle diets. Other food sources for bald eagles include fish, upland birds, small mammals, and carrion (Frenzel 1985; Hennes 1985). Bald eagles wintering near Provo, Utah, were reported to ingest lead shot while feeding on black-tailed jackrabbits (Platt 1976). Lead shot was found in 71% of the regurgitated pellets from over 100 of the Utah eagles.

Exposure and vulnerability of bald eagles to lead ammunition may partially offset one another, due to multiple biological factors. Harmata and Restani (1995) found higher lead concentrations in migrating bald eagles than golden eagles (97% versus 86% of birds with blood lead >0.20 ppm),[2] likely because of their higher consumption of waterfowl and greater scavenging of animal carcasses. The researchers noted fewer negative effects in the bald eagles, however, perhaps because the calcium rich diet (i.e. fish) of bald eagles could help reduce lead absorption.[3] Similarly, the high percentage of bald eagle castings containing lead pellets suggests that the species' lead assimilation is partially limited by regurgitation (Pattee et al. 1981). Harmata and Restani (1995) concluded that ingestion of prey items contaminated with lead shot or bullet fragments may cause briefly elevated blood lead concentrations rather than mortality or morbidity in healthy eagles.

However, these potentially mitigating biological mechanisms do not eliminate lead ammunition harm to bald eagles. Harmata and Restani (1995) found that bald eagles

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[2] Redig (1984) considered blood lead concentrations of 0.2 to 1.00 ppm in eagles indicative of toxic, chronic, sublethal exposure. Redig (pers. comm., as cited in Harmata and Restani (1995)) felt that eagles with lead concentrations of $\geq$0.80 ppm should be debilitated or appear sick. The USFWS has established blood lead levels of $\geq$0.5 ppm as indicating toxic but sublethal exposure for eagles (Redig 1985).
[3] Bald eagles with blood lead >0.4 ppm did not exhibit sublethal symptoms, and those used as lure birds in the study that were fed lead-shot prey did not exhibit sickness, lethargy, or debilitation.

may suffer significant poisoning from ingesting lead ammunition in the presence of exacerbating factors such as injury, disease, starvation, or exposure to other toxic contaminants. Harmata and Restani (1995) concluded that the continued use of lead shot in upland game hunting and of lead bullets in varmint and big game hunting is a significant cause of lead poisoning in some bald eagles. Moreover, not all shot or bullets are expelled, and eagles can easily be re-exposed during the hunting season. Indeed, exposed eagles may suffer impaired hunting ability, causing them to scavenge more and increasing the chances of re-exposure (Redig 1984). The potential for even relatively brief lead exposure to cause morbidity or mortality in bald eagles had been unequivocally established experimentally. Pattee et al. (1981) reported that some bald eagles exposed to 19-42 mg of dissolved lead died as soon as 3 weeks after exposures, and 16-23% of bald eagles ingesting lead shot showed weight losses.

2. **Golden Eagle** (*Aquila chrysaetos*)

The golden eagle is listed by CDFG as a species of special concern and is further listed as a Fully Protected species under the CESA, meaning it may not be taken or possessed at any time (CFGC § 5511).

Like bald eagles, there is little question that golden eagles suffer from elevated levels of lead in their blood. In one study, researchers conducted year-round monitoring of lead exposure in golden eagles trapped within the range of the California condor from 1985-1986, with eagles captured at the same bait stations as condors (Pattee et al. 1990). Some of the eagles were resident and others wintered in the condor range, feeding on live prey as well as carcasses. Pattee et al. (1990) found that 36% of 162 captured golden eagles had elevated blood lead levels indicating exposure to lead, with 3% suffering from acute lead poisoning, and 3% exhibiting clinical lead toxicity (Pattee et al. 1990). Although the researchers could not establish precisely how the golden eagles were exposed to the lead, Pattee et al. (1990) concluded that hunter shot carcasses was the most probable source. Analysis of the data by month demonstrated the highest exposure during and after hunting season and the lowest exposures just before hunting season. The high prevalence of lead in golden eagles was particularly notable since they are primarily predators, feeding on ground squirrels, jackrabbits, and upland birds, and only secondarily scavengers, feeding on big-game carcasses and shot ground squirrels (Ohlendorff 1976; Platt 1976; Frenzel 1985; Harmata and Restani 1995).

The California results were corroborated, and a more direct link to lead ammunition established, by Harmata and Restani (1995). They sampled 86 golden eagles for environmental contaminants from 1985 to 1993 during their spring migration through Montana. Harmata and Restani (1995) found that 86% of vernal migrant golden eagles were contaminated with lead, and 56% of golden eagles were exposed to lead at elevated levels ($\geq$0.20 ppm). Harmata and Restani (1995) observed up to 30 eagles at a time following plinkers[4] from field to field, scavenging ground squirrels the plinkers shot. Ingestion of lead shot, presumably in upland prey, has also been reported to cause

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[4] Plinking involves shooting ground squirrels and rabbits; plinkers typically shoot several animals per day and leave carcasses in the field, where they can be scavenged.

mortality of golden eagles in England (Locke and Friend 1992). Harmata and Restani (1995) concluded that continued use of lead shot in upland game hunting and of lead bullets in varmint and big game hunting is a significant cause of lead poisoning of golden eagles. Moreover, the predominantly mammalian diet of golden eagles may contain less calcium and could make them up to 3 times more sensitive to lead poisoning than bald eagles (Harmata and Restani 1995). Craig et al. (1990) attributed the deaths of golden eagles with blood lead concentrations of 0.54 and 0.23 ppm to lead poisoning, well below levels proposed by other researchers (Harmata and Restani 1995).

3. **California Condor** (*Gymnogyps californianus*)

The California condor is federally listed as an endangered species and is state listed as an endangered species under CESA. The California condor is further listed as a Fully Protected species under the CESA, meaning it may not be taken or possessed at any time (CFGC § 5511).

California condors share the general susceptibility to lead poisoning of birds that scavenge or prey on human-hunted wildlife. As detailed below, however, a series of factors makes their case more urgent. As of 2001, an estimated 35% of released condors had experienced acute lead poisoning (Wiemeyer et al. 1988; Risebrough et al. 2001). Toxicological data suggest that a fragment of lead as small as a single shotgun pellet could kill a condor (Snyder and Snyder 2000). Condors exposed to lead can die quickly of acute toxicity or, since they tend to retain consumed lead, may die slowly of starvation from lead-induced paralysis of the gastro-intestinal tract (Snyder and Snyder 2000). For more than the past decade, lead poisoning has been the second leading confirmed or suspected cause of condor deaths (Jurek 2003). Beyond that, however, the widespread exposure of condors to lead has likely resulted in pervasive neurological impairment, providing a possible explanation for other, non-lead mortality factors such as power line collisions, drownings, and predation by other carnivores (M. Fry, pers. comm., 2004).

The exceptional threats that lead poses to condors are matched by a much wider relevant literature than exists for other species affected by lead. The precarious, highly imperiled status of condors, together with the failure thus far of efforts to eliminate their exposure to lead, mandates that these threats be swiftly and effectively addressed. Because immediate action is needed to remove lead ammunition from the condor's range, we provide here an extensive review of the bird's biology, the history of efforts to recover the species, and the available science bearing on threats from lead ammunition.

a. Condor Biology, Distribution, and Abundance

The California condor is a member of the Vulture family (*Cathartidae*). Adult condors have the largest wingspan, at 9 to 10 feet, of any North American bird. Condors are exclusively carrion feeders, with feet adapted for walking, rather than seizing prey, and have naked heads suited to feeding in carcasses. Condors now feed mainly on carcasses of large terrestrial mammals but historically fed on dead marine mammals, whales, fish, and marine birds as well. Condors will congregate and feed intensively when local abundances of food develop and will also forage over an extremely wide range. Condors do not build nests, but rather lay their eggs on the floors of caves or in hollow tree stumps, assembling gravel and small debris within the nest chamber to rest the eggs upon. Condors lay single egg clutches, and because of long incubation and nestling periods and an extended period of juvenile dependency on adults after fledging, the total nesting cycle is more than one year. Condors generally reach breeding maturity after 6 or more years of age. Because of condors' very low reproductive rate and slow progress to maturity, the California condor population must maintain low mortality rates to survive.

Historically, the California condor ranged from northern Baja California, Mexico, to southern British Columbia, Canada, primarily along the coast but also extending inland in the southwestern United States. By 1850 condors had mostly disappeared from Washington and Oregon, and they were extirpated from Baja California by the 1930s. By the 1940s condors were restricted to a wishbone-shaped band of habitat, along the California coast range from Monterey to Los Angeles, and into Kern County and up the southern Sierra Nevada Mountains to Fresno County. By the 1980s, condors in the coastal portion of the range were generally found no further north than San Luis Obispo County (Snyder and Snyder 2000).

By the 1980s, this Y-shaped habitat range represented both the habitat of the entire species and the range of each of the known condors that remained. While habitat has declined considerably since the 1940s, the actual number of condors has plummeted disproportionately. The condor population was estimated to be about 150 birds in the 1950s, was reduced to 60 birds by 1970, and only 22 birds remained by 1982 (Snyder and Snyder 2000; Behrens and Brooks 2000). The condor was listed as an endangered species under the federal Endangered Species Act (ESA) in 1967 and as a fully protected endangered species under the California ESA in 1971.

A captive breeding program initiated in 1985 brought all remaining wild birds into captivity. The captive population was up to 63 birds by 1992, and efforts to reintroduce the condors to the wild began that year. As of November 1, 2004, there were a total of 246 condors, 111 of which were in the wild. Fifty-four condors occupied portions of their historical habitat range in California, an additional 49 were in Arizona near the Grand Canyon as an experimental population, and 8 condors occupied habitat in Baja California, Mexico (CDFG 2004).

b. Condor Mortality Rates and Factors

Despite an intensive recovery effort, mortality rates for California condors are extreme. Of 67 condors in the southern California release from 1992 to 2002, 32 birds (48%) have died or disappeared and are presumed dead (USFWS 2004a). Of 54 condors released in Arizona from 1996 to 2002, 20 birds (37%) have died or disappeared and are presumed dead (Cade et al. 2004). Because condors do not reproduce until they are six to eight years old (Meretsky et al. 2002), these mortality rates have particularly dire implications for efforts to re-establish the birds in the wild.

Condors have been declining in number since the arrival of European settlers. Early documented causes of mortality included environmental factors such as drowning, fire, and hailstorms. However, researchers attribute the species' population declines to human influences. Snyder and Snyder (2000) list several human-caused factors: ritual sacrifice, quill collecting, museum collection of birds (and to a lesser extent, eggs), shooting, poisoning from efforts directed at mammalian predators, collisions with utility poles and wires, and lead poisoning. Habitat loss has not been quantified in direct-mortality studies, but certainly increased condors' exposure to other threats. Habitat loss remains a serious issue for the long-term survival of the species, but condors currently face even greater threats from direct mortality factors, as described below.

Mortality data have grown in quantity and quality since the 1980s and especially since reintroduction began in the 1990s. Collection has long ceased to be a mortality threat, but other human-caused factors, including non-lead poisoning, shooting, collisions, and lead poisoning, persist. As more data have been collected, it has become increasingly clear that the most significant mortality factor is lead poisoning. Strikingly, it is the factor that has been least adequately addressed by recovery efforts.

i. Non-lead Poisoning

Historically, human-caused poisoning killed numerous condors. Predator and pest control activities indirectly killed condors that fed on poisoned bait carcasses, or occasionally directly killed condors themselves. Such poisons have included strychnine, cyanide, thallium sulfate, and compound 1080 (Snyder and Snyder 2000). While many early condor deaths were likely caused by poisoning, most of the poisons have either been abandoned or the techniques changed to minimize contact with non-target species such as the condor, and they are thus no longer considered a significant mortality threat. No condors are known to have been killed due to predator or pest poisoning efforts since reintroduction began. Antifreeze (ethylene glycol) is another poison, in addition to lead, that remains a potential mortality factor for the condor. One condor death in 1992 was attributed to antifreeze poisoning (Snyder and Snyder 2000). Although it remains a preventable mortality factor, the single occurrence since reintroduction suggests that it is not a major one. In 2000, the Center for Biological Diversity reached an agreement with the Forest Service to discontinue use of ethylocol-based antifreeze in Forest Service vehicles in the four southern California National Forests and to conduct an education campaign urging the public to also use alternative non-lethal antifreeze.

ii. Shooting

Snyder and Snyder (2000) conclude that early data might have over-emphasized shooting as a mortality factor, as it usually occurred in accessible areas where the condor carcass was found and the cause of death was fairly easily determinable. Shooting was nonetheless significant, and remains a mortality factor despite strong laws prohibiting it. A condor was shot and killed by a hunter as recently as 2003 (Jurek 2003). Hunter education programs and enforcement efforts may plausibly continue to reduce this threat, if they are adequately supported.

iii. Power Line Collisions / Electrocutions

Collisions with overhead wires became a mortality threat once the wires were strung through condor habitat, with at least one death documented in 1965 from a collision with telephone wire and very likely others occurring that were undocumented (Snyder and Snyder 2000). Until the recovery program started releasing condors, however, power line collisions were a relatively minor factor. Since 1989, at least 10 California condors have died after colliding with power lines (Jurek 2003).

Power line collisions have thus been the greatest documented source of mortality in released condors. However, most, if not all, of this threat has been linked to flawed release training and procedures (Meretsky 1999). Once the threat was realized, aversive training was incorporated into the release program by wiring utility poles in release cages to emit a shock to the condor. Collision deaths are expected to diminish, although Snyder and Snyder (2000) point out that collisions with utility wires are an ongoing major problem for African vultures.

iv. Lead Poisoning

Although its seriousness has only recently been recognized, lead poisoning is a long-standing threat to California condors. Early condors found dead were not tested for blood-lead levels, and up until the mid-1980s lead poisoning was regarded as only one of many possible mortality factors (Snyder and Snyder 2000). However, data from the 1980s showing that mortality rates of juvenile and adult condors were nearly identical strongly implicates lead poisoning as a major factor in the decline of wild condors (Snyder and Snyder 2000). It is unusual for adult mortality to be as high as juvenile mortality in any raptor species, but lead poisoning, unlike collisions (the other major cause of condor death) is not age dependent (N. Snyder, pers. comm., 2004; Meretsky et al. 2000).[5]

The impact of lead poisoning became clear with increased study and monitoring, and recovery efforts from the 1980s onwards sought to provide wild condors with lead-free carcasses. Lead poisoning is now widely acknowledged as the most serious threat to the long-term survival of the condor. The removal of all wild birds to a captive breeding program in 1985, approved by the Commission and CDFG, was undertaken primarily because of the threat of lead poisoning. Both the CDFG (Fry and Maurer 2003) and the USFWS California Condor Recovery Team (Redig et al. 2003) have released expert reports describing the seriousness of the lead poisoning threat.

Since at least 1992, only collisions have caused more actual condor deaths than lead poisoning, with 5 confirmed lead mortalities between 1992 and 2003 (Jurek 2003).

[5] A study of golden eagle mortality in the California condor range (Patte et al. 1990) showed a similar unusual proportion of adult mortality.

Three or four other deaths are strongly suspected to stem from lead poisoning (Jurek 2003; Cade et al. 2004; USFWS 2004a). In all, 12 of 58 mortalities in recent releases have been confirmed or are suspected to have been due to lead poisoning.

In addition, at least 14 other released condors have gone "missing" and are presumed dead of unknown causes. Some of these disappearances are plausibly attributable to lead poisoning As discussed above, sublethal toxic lead exposure in raptors is associated with debilitating conditions that can lead to death by causes including anorexia, impaired vision and motor activity, disease, and collision (Scott and Eschmeyer 1980; Reiser and Temple 1981; Pattee et al. 1981; Redig 1985). Some of the missing birds had previously been documented with high blood lead levels (USFWS 2004a).

Moreover, as of 2002, there had been at least 33 intrusive emergency chelation therapies performed on released birds to prevent their deaths from lead poisoning (Cade et al. 2004; USFWS 2004a). Considering such interventions as functional mortalities, as Meretsky et al. (2000) recommend, lead poisoning is far and away the single greatest mortality threat and perhaps the only factor that alone threatens the condor's continued existence. Considering chelation as mortalities is justified for several reasons. First, funding to continue the expensive and resources-intensive practice is uncertain. Second, because the principal technique for avoiding chelation, food subsidy, tends to become less effective over time as birds learn to identify and feed on natural carcasses, the need for chelation is likely to increase, not subside. Third, chelation also may contribute to the birds' habituation to human beings, a phenomenon that increases both their vulnerability and the likelihood they will have to be removed from the wild. Fourth, chelation is no guarantee against neuro-impairment and other chronic, potentially life-threatening impacts from acute poisoning. And, finally, ongoing dependence on chelation is fundamentally inconsistent with the goal of recovery of the species to a self-sustaining natural state.

Although there is a lack of conclusive data on what blood lead levels are lethal or harmful to condors, studies on other species and on humans provide some guidance. Pattee et al. (1990) estimated the adverse effect levels of lead exposure in condors based on research with captive Andean Condors and wild golden eagles in California. They characterized the lead exposure of condors based on blood lead levels as follows: <0.20 parts per million (ppm) as background, 0.20 to 0.59 ppm as exposed, 0.60 to 0.99 ppm as clinically affected, and >1.0 ppm as acute. These are the same exposure criteria proposed by Redig (1984) from studies of bald eagles.

Blood level tests were conducted on released condors managed by the USFWS Ventura Field Office[6] between January of 1997 and June of 2004.[7] An analysis of the

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[6] Condors released at the Hopper Mountain release site are managed by the Ventura Field Office of the U.S. Fish and Wildlife Office, while condors released at Pinnacles are managed by the Ventana Wilderness Society. There is a very small amount of overlap, however, in that some condors have traveled between the two sites. Thus, some of the condors included in the Hopper Mountain totals were originally released in the Pinnacles.

data shows lead exposure at "background" or lower levels in 114 samples out of 207 (55%), 77 samples (37%) at the "exposed" rate, 10 samples (5%) at the "clinically affected" rate, and 6 samples (3%) showing "acute" exposure. Of the 207 total samples, 45% showed lead levels greater than the background level of 0.20 ppm. These 207 samples were taken from 44 individual condors, with 35 birds (80%) showing lead levels greater than "background" level at least once in the testing period (USFWS 2004b).

The effects of lead on condors are most likely not limited to instances when their blood level is >0.20 ppm. Studies of humans have shown neurological effects of lead exposure at levels as low as 0.05 ppm (Canfield et al. 2003). Testing of humans can definitively detect neurological impairment in intelligence or motor skills that is not possible with tests conducted on wildlife. There is little reason for confidence that higher blood lead concentration levels would be needed for neurological impairment of condors, suggesting that the "background" level of 0.20 ppm may reflect some widespread neurological impairment in the species (Eisler 1988; ATSDR 1999; Canfield et al. 2003). In the samples of Hopper Mountain condors discussed above, 86% of the condors had lead levels of greater than 0.10 ppm at least once between 1997 and 2004, and 72% of all of the samples collected measured above 0.10 ppm.

v. Ingestion of Trash

Ingestion of trash is a mortality factor for condor chicks, and may be to some degree for adults as well. Condors tend to pick up and eat trash (particularly small, shiny objects such as bottle caps, glass, electrical equipment, and miscellaneous other small objects of human origin), likely mistaking trash objects for bone fragments from which they obtain their calcium. At least 3 California condor chicks have died in the past three years after ingesting large amounts of trash (McKenna 2004). Glass shards and metal scraps have killed or threatened 2 of the 3 chicks born in the wild in 2004; one bird was found dead with 4 ounces of trash in its stomach and the other was found with 35 bottle caps in its stomach. The only chick born in the wild in 2003 exhibited stunted growth after ingesting large amounts of trash and eventually had to be euthanized after ingested glass shards perforated its stomach (McKenna 2004). In 2002 a chick died of zinc poisoning after ingesting electrical fixtures, screws, and washers coated with zinc (McKenna 2004). There is some concern that ingested trash could also contain lead that could contribute to mortalities. Thus far there is no affirmative evidence that lead ingested with trash is a significant source of mortality for condors, and bottle caps and pull tabs do not contain lead. The ingestion of trash may be a problem of condor acclimation, as tame birds are more likely to frequent human habitation and the problem of garbage ingestion is notably much greater among California condors that are provided with greater food subsidy than among Arizona birds. This behavior may also prove to be a result of neurological impairment caused by the toxic effects of lead even at background levels.

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[7] Blood lead level tests were also conducted starting as far back as 1966, but not systematically.

c. Potential Sources of Lead Poisoning in Condors

A CDFG report (Fry and Maurer 2003) evaluated the four most likely potential sources of lead in the environment for condors: 1) lead fragments in carcasses of animals shot with lead rifle or shotgun ammunition; 2) potential lead residues in calf carcasses used in the condor feeding program; 3) atmospheric lead from gasoline exhaust; and 4) soil lead, including natural lead deposits, residual lead from atmospheric deposition, and lead in soils of landfills, dumps, and rifle ranges. Fry and Maurer concluded that when all the potential sources of lead are considered, fragments from hunter-shot carcasses appear to be the most likely source of lead exposure for condors. Snyder and Snyder (2000) remarked that "inadvertent lead poisoning from deer hunting could have been the most important single cause of the condor's extirpation."

i. Lead Ammunition

Condor researchers believe that lead ingested from carrion containing lead ammunition fragments is the most likely source of lead exposure to condors (Snyder and Snyder 2000). The known lead poisoning incidents of monitored condors corroborate this conclusion. A wild condor found dead in March 1984 in Springville in the Sierra Nevada had a lead bullet fragment in its digestive tract, and lead poisoning from the ingested bullet was thought to be the cause of mortality (Snyder and Snyder 2000). Another wild condor found in January 1986 at Hudson Ranch with a metallic fragment in her ventriculus died of lead poisoning (Snyder and Snyder 2000). Almost all documented condor mortality from 1982 through 1986 occurred during the fall to spring period, a result consistent with lead toxicity, assuming lead exposure results mainly from hunting, but not consistent with other sources of mortality (Snyder and Snyder 2000). In 1997 three condors in the release program in California suffered lead poisoning as a result of feeding on a single hunter-shot deer carcass (Hendron 1998). An x-ray of a Hopper Mountain bird that required chelation treatment in 2002 revealed a lead bullet fragment (USFWS 2004a). Four of the five Arizona condors whose deaths have been definitively linked to lead poisoning had lead ammunition (shot or bullet fragments) in their digestive tracts, with an additional condor treated for the presence of a lead bullet fragment in its gut (Cade et al., 2004).

The principal sources of ammunition-based poisoning appear to be game species shot by hunters, such as deer and pigs, and "pest" species shot by ranchers and plinkers, such as coyotes and ground squirrels. Most animals which condors are known to scavenge upon (such as deer, coyotes, and ground squirrels) are typically hunted with lead bullets in California, suggesting that bullets are the major poisoning threat to condors. Conventional lead bullets leave a trail of lead fragments in the carcass of shot animals. Although there are few records of condors eating species hunted with lead shot, such as rabbits, waterfowl, and quail, condors have been documented feeding on jackrabbits (Koford 1950; Wilbur 1978) and condors are certainly capable of feeding on carrion killed by lead shot if it is available. In 2001, eleven condors were poisoned, and two died, after ingesting shotgun pellets in Arizona, apparently at a carcass or carcasses that had been used for target practice (USFWS 2001).

Sometimes animals shot by hunters are never recovered and typically coyotes and other "pest" species are left where they are shot. Whether they die at the time, or survive and die later, the lead in their carcasses is or becomes available to condors, and may be mistaken for bone and preferentially ingested by them as they seek out sources of calcium (Snyder and Snyder 2000). Lead fragments can also be found in the gut piles of game species that are typically dressed in the field. Although there are no documented cases of condors feeding on them, there have been numerous observations of condors near gut piles, which are suspected to be a favored food source for condors. In studies conducted during the 1970s and 1980s, condors concentrated in the Tehachapi Mountains during the fall hunting season and fed heavily on the remains of deer, large numbers of which were shot every season (Wilbur 1978; Snyder and Snyder 2000).

Fry and Maurer (2003) quantified hunter-shot carcasses available to condors, and concluded that gut piles and whole carcasses left in the field by hunters are a highly significant source of lead within the condor range. They obtained hunting survey data by county and hunt zone from the CDFG, for the eight counties encompassing the condor range. Fry and Maurer (2003) estimated an annual average of 17,000 wild pigs, 11,000 coyotes (excluding 2,700 shot by government predator control), and 8,000 deer are taken each year by hunters within the range of the condor. These 36,000 big game animals represent about one-third of the total number of animals legally shot each year within the condor range (the majority being rabbits and tree squirrels), but the carcasses of these large animals would, as discussed above, be the primary source of hunter-shot food for condors.[8] The Fry and Maurer (2003) figures do not account for poaching, which likely significantly increases the number of deer carcasses available.

Fry and Maurer (2003) assumed that only a very few gut piles are actually buried, hidden successfully, or removed from the field. Deer and pigs are generally field dressed and gut piles discarded in the field; coyotes are generally left in the field intact. The CDFG has made no estimate of voluntary compliance with its hunter education program for burying gut piles within the condor range

Though as suggested above, large game carcasses are the primary food source for condors, small game may contribute significantly to their lead risks. Fry and Maurer (2003) estimated that almost 14,000 tree squirrel and rabbit carcasses, and at least as many more ground squirrel carcasses, are left in the field within the condor range. Even animals as small as ground squirrels shot with .22 caliber bullets can contain lead fragments: Harmata and Restani (1995) reported that of 32 squirrels shot with .22 caliber long rifle hollow-point bullets, radiographs of the carcasses showed that 18 (56%) had visible lead fragments, as did 6 of 8 (75%) shot with .22 caliber magnum HP loads. Knopper et al. (In print) found that 14 of 15 Richardson's ground squirrels (*Spermophilus*

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[8] Fry and Maurer note that although hunting causes a fraction of the total statewide deer mortality, it may represent a large percentage of the carrion available to condors. Natural predation by mountain lions does not often make carrion available to condors because lions cache carcasses where they are hidden from visual scavengers. The bulk of other deer mortality would be from hunter-shot cripples, road kills, and malnutrition deaths.

richardsonii) shot by bullets during a "gopher derby" in Canada had visible bullet fragments which they detected by radiograph. Lead levels in the squirrel carcasses ranged from non-detectable in the one carcass without visible fragments to 0.10-26.07 mg/kg body mass (wt) in carcasses with fragments. Knopper et al. (in print) concluded that lead fragments were present at biologically relevant levels that may constitute a lead-hazard for scavenging birds of prey.

Before 1985, federal predator-control trappers dispatched trapped coyotes with lead bullets, leaving the carcasses in the field as potential food for condors and other scavengers (Snyder and Snyder 2000). In 1985 the USFWS required that the USDA Animal Damage Control agency (now "Wildlife Services") reduce condor exposure to lead ammunition used for predator control. The USFWS decreed that "aerial shooting, shooting from the ground, denning, snaring, and leg hold traps are allowable control methods as long as steel shot is used (aerial shooting) and/or animals killed by lead shot are buried or removed from the condor range." The USDA predator control hunters apparently still use lead shot to kill coyotes within the condor range, but reportedly examine carcasses and dispose of them through burial, dumping in a ravine, or removal if no exit wound is found (Fry and Maurer 2003). Because the USDA has changed the manner with which they dispatch trapped coyotes, the use of lead ammunition by hunters now stands alone as the primary source of lead poisoning for condors (Snyder and Snyder 2000).

ii. Tainted Food Subsidy

Animal carcasses fed to condors during the early years of the recovery program, including white rats fed to condors at the Los Angeles Zoo and domestic goats provided for condors in the field, contained substantial quantities of lead (Wiemeyer et al. 1983). In an effort to reduce potential contamination, carcasses of dairy calves have been used for the supplemental feeding program since then (Fry and Maurer 2003). Dairy calf carcasses were analyzed in 1994 and found to have low lead levels (Fry and Maurer 2003). Because of concern about heavy metal residues in cattle silage,[9] a testing program for dairy calf carcasses used in the condor supplemental feeding program is underway (Fry and Maurer 2003). Lead was not detected in any samples of dairy calf livers tested in 2003 (Fry and Maurer 2003).

iii. Atmospheric Lead Deposition

Fry and Maurer (2003) concluded that atmospheric lead does not appear to be a significant source of lead exposure to condors. Potential atmospheric sources of lead in California include leaded gasoline exhaust, and emissions from smelters and battery manufacturers. Atmospheric releases of lead have been reduced dramatically by the phased reduction of lead in gasoline from 1973 to 1986 and the complete elimination of leaded gasoline for highway use in 1996. Recent EPA data indicate that California

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[9] Disposal of sewage sludge containing heavy metal residues as fertilizer has become common practice, especially for forage crops such as silage corn and hay, which are the primary food source for dairy cattle.

emissions of lead are relatively small and originate outside the range of the condor, and the prevailing winds are such that little of the lead released into the atmosphere in California would be deposited within the range of the condor (Fry and Maurer 2003). Indications that atmospheric lead is not the primary exposure source for condors are corroborated by the fact that blood levels of captive condors held in urban zoo environments have proven to be relatively low (Wiemeyer et al. 1986).

iv. Soil Lead Residues

Lead deposited into the soil, generally from the atmosphere, also does not appear to be a significant risk factor for condors. Lead was deposited into the soil during the half century when leaded gasoline was in use, and continues to cycle through the food web. The primary exposure risk to condors would be through scavenging on herbivores (both rodents and ungulates) that graze on plants which have bio-accumulated lead. Wiemeyer et al. (1983, 1986) sampled carcasses of deer, cattle, and sheep within the range of the condor to examine the amount of lead available to condors through this mechanism, and concluded the risk to condors was minimal. Leaded gasoline has been eliminated since that assessment, so the potential risk should now be even lower. These results are consistent with studies of lead poisoning in other raptor species, which conclude that exposure results from ingestion of metallic lead rather than from feeding on the tissue of prey that have bio-accumulated lead (Stendall 1980; Franson et al. 1983; Custer et al. 1984).

The few other potential local lead sources in soils within the range of the condor also do not appear to pose significant threats to the birds. These sources include military reservations and shooting ranges. A small number of mines historically produced or refined lead in California, but all were located to the east of the condor range. The two greatest potential sources are "impact zones" used for small arms and artillery training at Fort Hunter Liggett and Camp Roberts. As with atmospheric lead, the potential soil lead risk to condors stems from bioaccumulation of lead in plants and food chain transfer to grazing herbivores. Condors have been documented foraging at Fort Hunter Liggett. The amount of lead that herbivores could bio-accumulate from impact zones is unknown, but condors released at Ventana, which would forage at Fort Hunter Liggett, have averaged lower blood levels than birds at Sespe, strongly indicating that biologically incorporated lead from soils at Hunter Liggett is not a likely significant source for condors.

d. Efforts to Address the Lead Threat to Condors

The USFWS has failed to eliminate lead poisoning risks to condors in the context of a regulatory regime that allows widespread use of lead bullets throughout the range of the condor. The agency's unsuccessful efforts include an artificial feeding program, rigorous blood sampling and testing, and chelation therapy for poisoned birds. Attempts to mitigate lead exposure through hunter education, voluntary use of alternative bullets, and encouraging removal or burial of lead contaminated carcasses have proved similarly ineffective.

i. Food Subsidy

Released condors have for years received an artificial food subsidy of "clean" cattle carcasses, without abatement of the underlying lead threat to the birds. Food subsidy was not fully effective even initially, and has become even less so over time. Moreover, the food subsidy program has serious drawbacks, primarily making condors chronically dependent on human intervention, which is inconsistent with recovery of the species. The food subsidy has the additional pitfalls of concentrating condors in geographic areas where they are inherently less secure and also acclimating them to human activity, which may reduce their avoidance of human beings and settlements.

In the mid-1980s, when the lead poisoning threat to remaining wild condors became apparent, the USFWS California Condor Recovery Team attempted to abate the threat temporarily by providing the wild population with lead-free food. The recovery team did not hold much hope for this artificial feeding program because of poor results from similar attempts in the 1970s (Snyder and Snyder 2000). Previous efforts to feed wild condors at carcass stations had never resulted in birds abandoning their natural wide-ranging foraging patterns and becoming entirely dependent on provided food (Wilbur et al. 1974; Wilbur 1978; Snyder and Snyder 1989). This is probably because condors employ a mixed feeding strategy, congregating intensively when food is locally abundant, but also patrolling more widely as long as food is available in other parts of the foraging range.

Nonetheless, biologists began regularly to provide clean carcasses for wild condors on Hudson Ranch in the spring of 1985. Although carcasses were made continuously available and condors fed on them to some extent, they did not develop a strong dependency on the subsidy. Golden eagles and ravens, by contrast, fed on them extensively. During the fall of 1985, the wild condor population shifted to feeding on hunter-shot deer in the Tehachapi Mountains. Subsequent efforts to offer clean carcasses in the Tehachapi Mountains attracted very few condors. Snyder and Snyder (2000) estimated that the wild population at the time was obtaining at most 20% of its food from the carcasses provided at Hudson Ranch. Significantly, the individual condor that fed most frequently on clean carcasses at Hudson Ranch died from lead poisoning, apparently from eating lead-shot deer remains in the Tehachapi Mountains. This indicated that the feeding program could not save even those birds that utilized it most as intended. Snyder and Snyder (2000) concluded that "clearly the feeding program was not an adequate answer to the threat" to wild condors.

Since captive-reared condors were released to the wild beginning in the 1990s, they have also been provided with lead-free carcasses. This food subsidy program was also intended as an interim plan, to be phased out when better solutions became available (Snyder and Snyder 2000). The goal envisioned for the initial releases was to prevent released birds from feeding on natural carcasses until lead contamination threats were addressed in the condor range.

Although experienced wild condors apparently will not feed exclusively on carcasses provided at a feeding station, the possibility of training captive-reared birds at first appeared more favorable. Based on the documented difficulty in training captive-reared Andean condors to abandon their reliance on provided food (Wallace and Temple 1987b), it was believed that captive-reared California condors would have no motivation to learn wide-ranging foraging patterns, so long as carcasses were consistently provided at a single location. Studies of Eurasian griffon vultures released to the wild in France (Terrasse 1985, 1988) also showed that the released birds tended to remain quite dependent on food subsidies and had to be trained to search for food at multiple sites.

However, released California condors that have been in the wild for more than a year or two have begun to feed upon naturally-available carcasses, once again exposing the species to lead contamination. Many recent lead poisoning incidents have occurred with condors from the releases that have been ongoing for the longest time. However, condors from later releases are now also beginning to abandon provided food and to forage for natural carcasses. The available evidence indicates that these birds, too, will begin experiencing increased lead poisoning. In Arizona, problems with lead poisoning did not materialize until the fourth year of the releases (Cade et al. 2004).

ii. Chelation Therapy

Chelation therapy has recently been used as a stop-gap measure to save acutely poisoned condors, but its intrusiveness, serendipitous nature, and potentially serious adverse side-effects eliminate it as a long-term solution. In 1997, three of ten California condors observed feeding on a hunter-shot deer carcass developed acute lead poisoning. Through luck and the vigilance of the condor release team, the poisoning was detected immediately and the birds were successfully captured and detoxified by chelation therapy in captivity (Hendron 1998). Three more condors with lead poisoning required chelation treatment in 1998, including a bird that very nearly died in the field before it could be captured and detoxified. These birds survived acute lead poisoning only because the lead exposure was detected promptly. In Arizona from 2000-2002, condors had to be treated for high blood levels 24 times, including many seen feeding at deer carcasses (Cade et al. 2004). By 2002, there had been at least 33 chelation treatments for lead-poisoned condors in the Arizona and southern California releases (Cade et al. 2004; USFWS 2004a).

Chelation therapy is a highly intrusive, expensive, emergency treatment. The lengthy procedure is painful and stressful for the birds, involving capture and manual injections twice daily until blood lead concentrations drop to background levels. Whether chelated birds ever regain fully functional behavior is unknown, as are the long-term side effects of treatment. Based on the learned and transferred behavioral traits observed in the species, the potential is high for lasting maladaptive impacts on both treated birds and those with which they come into contact. However indispensable chelation has been as an emergency measure, it is plainly not an efficient, desirable, or even viable long-term response to the threat of lead exposure.

Even where chelation therapy is used to prevent condor deaths, harm to birds may be permanent, both because of lingering behavioral deficits as a result of diminished mental capacity from lead poisoning, and/or the therapy contributing to acclimation to humans. Although artificial rearing conditions and human proximity to captive-raised birds are likely the primary factors acclimating released condors to human beings, repeated proximity to and handling by humans as part of the process of monitoring, testing, and treating lead-poisoned birds is likely also a significant factor. These reinforcing factors are likely aggravated by the use of feeding stations for lead-free food subsidies and the resultant association of humans with food. The inevitable result of human acclimation is tame birds with elevated mortality risk through a variety of mechanisms. For example, the problem of garbage ingestion is notably much greater among California condors that are provided with greater food subsidy than the Arizona releases. Despite aversive conditioning provided as part of the release program, chelated birds that are handled by humans can transfer human acclimation to other released birds. As long as toxicity associated with lead ammunition remains a rationale for continued food subsidy, the release program will reinforce conditions and behaviors that are inconsistent with recovery of the species to non-threatened status. The sooner the lead problem is solved, the sooner released birds can be taken off food subsidy, reducing the risk of acclimation and risky bird behavior.

iii. Hunter Education

The USFWS, CDFG, and U. S. Forest Service have all made efforts to reduce condor exposure to lead through hunter education programs that encourage the voluntary use of alternative bullets. Some agencies and land managers are encouraging or requiring removal or burial of lead contaminated carcasses and viscera, but in reality, these measures will not come close to adequately reducing the amount of lead available to condors. Getting hunters to bury or remove gut piles is not realistic for a variety of reasons. First, the work involved in burying gut piles deeply or actually removing them from the field is substantial, and normally would be done unobserved and without feedback. Second, even if gut piles are buried, large scavengers such as bears, coyotes and foxes can readily locate them by smell, unearth them, and drag them into the open where visual scavengers such as condors may find them (Fry and Maurer 2003). And third, this leaves unaddressed the lead disseminated by way of game that is wounded and never found by hunters and carcasses that are the result of plinking, where there is no intention to retrieve the carcass. Removing bullets from abandoned carcasses or gut piles is unrealistic since it would require a thorough radiographic examination of the carcass and location of all the bullet fragments that are distributed throughout the carcass (M. Fry, pers. comm., 2004).

Encouraging voluntary use of alternative bullets is likewise ineffective to assure that condors are protected from lead bullet ingestion. Despite the availability of alternative ammunition, extensive educational efforts, and bullet rebate programs, very few hunters have voluntarily made the switch to non-lead ammunition. CDFG included a request in this year's hunting regulations that hunters in the condor range voluntarily use ammunition other than lead-based rounds. The Forest Service's "Help Get the Lead Out

Rebate Program" offering $15 to big-game hunters who used lead-free rifle ammunition was initiated in 2003 in the Los Padres National Forest. The Santa Barbara Daily Nexus reported on the program's failure to reach significant numbers of hunters in its October 3, 2003 story "Hunters Ignore Rebate on Lead-Free Bullet" (Dozier 2003). The story interviewed a local gun shop owner who was not optimistic that lead-free ammunition sales would increase and concluded that "the only way you're going to get people to buy [non-lead ammunition] is to have the government make it mandatory to use it." Neither the Forest Service nor CDFG have published any information that indicates that significant numbers of hunters are using non-lead ammunition.

C. Toxic Effects of Lead on Humans

Lead poisoning is not just a wildlife issue, but is also an environmental health issue. In the United States lead has been prohibited in everything from gasoline to water systems and household paints.

Lead is an extraordinarily toxic element, and when ingested it attacks organs and many different body systems, including the blood-forming, nervous, urinary, and reproductive systems (USDHHS 1999). Lead is especially dangerous to fetuses and young children (ibid.). In large enough doses, lead can cause brain damage leading to seizures, coma, and death (ibid.). Chronic overexposure to low levels of lead can cause health impairments to develop over time, and irreversible damage can occur without obvious symptoms (ibid.). The effects of lead poisoning include: damage to the brain and central nervous system; kidney disease; high blood pressure; anemia; and damage to the reproductive system, including decreased sex drive, abnormal menstrual periods, impotence, premature ejaculation, sterility, reduction in number of sperm cells, and damage to sperm cells resulting in birth defects, miscarriage, and stillbirth (ibid.).

Hunters who use lead bullets are at risk of lead poisoning in several ways. One exposure mechanism is inhalation of airborne lead created by friction from lead slugs against the gun barrel (KDHE 2004). Inhaled lead enters the bloodstream and is distributed throughout the body (ibid.). If the lead concentration is high enough, negative health effects will occur. Hunters who handle lead bullets are also at risk of ingesting lead residue (ibid.).

The most serious exposure is from accidental ingestion of lead shot pellets or lead bullet fragments embedded in meat. Health effects in human beings following ingestion of whole lead shot pellets have been reported in many cases, and ingestion of meat tissues containing minute flakes or fragments of metallic lead from the passage of lead shot or lead bullet fragments through the tissues is also possible (Scheuhammer and Norris 1995). A study of lead concentrations in tissues of waterfowl killed by shotgun (Frank 1986) showed high amounts of lead (>100 mg/kg) and confirmed the presence of lead fragments by X-ray. Particles of lead ranged from irregular fragments 1–2 mm in length to very fine dust, resulting from the disruption of lead shot pellets upon collision with bone (Frank 1986). Researchers have also detected lead fragments visible by radiograph in carcasses of squirrels shot with bullets (Harmata and Restani 1995; Knopper et al., in review). The flesh of any species of game animal killed with lead shot or lead bullets can become contaminated with high concentrations of lead through this mechanism.

A Canadian study of blood lead levels in hunters (Nieboer 2001) showed that lead from shotgun shells used to harvest wild game is a major source of exposure to lead in Native American communities in Canada. Blood lead levels were demonstrated to be higher in Native hunting communities than in a nearby reference group. Blood lead levels were also higher in men than women, consistent with greater participation of males in hunting and greater consumption of bagged wild fowl. Blood lead levels were shown to increase in male hunters during the hunting season, and one of the measured lead isotope ratios also changed in a manner consistent with exposure to lead derived from leaded ammunition.

D. Regulation of Hunting of Mammals and Birds

1. Authority for Regulation

The California Fish and Game Code (CFGC) delegates authority to the Commission to promulgate regulations concerning all taking of mammals and birds in California (CFGC §§ 200, 202 and 203); the Commission's hunting regulations are found at 14 CCR §§ 1.04–886.6. The Commission's authority is far-reaching: it prescribes the manner and means of taking game, sets the dates for hunting seasons, establishes bag and possession limits, establishes hunting territorial boundaries, and establishes restrictions based on physical characteristics of game (CFGC § 203). The Commission may set regulations for all areas of the state and for all species and subspecies, both game and non-species or not (*id.*).

A California hunting license is required for taking any bird or mammal, and must be carried and shown if requested (CFGC §§ 1054.2 and 3007, 14 CCR § 700). "Take" is defined by the CFGC as to "hunt, pursue, catch, capture, or kill, or attempt to hunt, pursue, catch, capture, or kill" (*id.* § 86). The Commission determines the form, terms, and conditions of hunting licenses (CFGC § 1050). Hunting licenses are issued upon the payment of license fees and proof of completion of a hunter education course or passing of an equivalency test (*id.* §§ 1053.5, 3031 and 3050).

The CFGC prohibits the use of other toxic substances due to wildlife poisoning concerns.   For example CFGC § 3003.2 prohibits the poisoning or attempted poisoning of any animal in California using Compound 1080, or sodium cyanide. The Commission can similarly restrict the use of lead due to poisoning concerns.

The CFGC assigns penalties and punishments for violations of the CFGC and Commission Regulations, including one year license and/or tag revocation for first-time violations and three year revocation for third-time violations (CFGC §§ 4340, 4754, 12155).

2. Regulations Concerning Take

a. Regulations Concerning Take of Big Game Mammals, Fur-Bearing Mammals, and Game Birds

In addition to a valid license, hunters must possess a species-specific license tag to take big game (deer, bighorn sheep, prong-horned antelope, elk, bear and wild pigs). Big game tags are awarded in drawings held before each hunting season (14 CCR § 708). The seasons for the different big game species differ with each species, and within each species depending on the hunting area. Deer seasons are mostly in September and October, with archery deer seasons about a month earlier (*id.* §§ 360 and 361). Bear seasons are generally the month following the close of deer seasons (*id.* § 365). The season for wild pig is open all year (*id.* § 368). In addition to time and place restrictions, the Commission restricts the methods used for taking big game, including types of firearms and ammunition allowed (*id*. § 353).

No special tag is required for hunting of fur-bearing mammals, such as pine marten, mink, foxes, raccoon, and muskrat, with firearms or bow-and-arrow, though the use of traps or poison requires special permits and a general hunting license is still required (CFGC §§ 4003, 4005). Fur-bearing mammal season is from November 16 to the day before the last day of February (*id.* At § 4001).

Game bird seasons vary by species. Hunting of upland game birds requires an upland game bird stamp (*id.* at § 3682) and duck hunters must obtain duck stamps and duck hunting validations (*id.* at §§ 3700 and 3700.1). Regulations of the allowable methods of take, including weapon and ammunition type, also vary by bird species (14 CCR §§ 300, 311, and 507).

b. Regulations Concerning Take of Non-game Mammals and Depredators

Non-game mammals are described as “all mammals occurring naturally in California which are not game mammals, fully protected mammals, or fur-bearing mammals” (CFGC § 4150). This definition thus includes “varmints” like coyotes and ground squirrels. Take of non-game mammals is generally allowed year-round when the mammal is causing damage to property (*id. at* § 4152). No special permit is required, although the method of take is still regulated by the CDFG, and a general hunting license is still required (*id*. and 14 CCR § 700). Taking of depredators (usually game mammals causing damage to property) requires a special permit, with limited exceptions, and the method of take is again regulated (CFGC §§ 4180 – 4190).

3. Regulation of Lead Ammunition

In 1991 the USFWS banned the use or possession of lead shot while hunting waterfowl (50 CFR § 20.21(j)). This regulation was passed as a result of a lawsuit brought by a coalition of environmental groups, filed under the Endangered Species Act, in response to lead poisoning of waterfowl and secondary poisoning of eagles caused by lead shot. Regulations were phased in nationally over a five year period, with additional zones designated as requiring non-toxic shot each year. By September 1, 1991, every state was designated as a non-toxic shot zone for hunting waterfowl, coots and certain other species (50 CFR 20.108). Since then, lead poisoning of loons, swans, upland game, and the continued poisoning of eagles prompted additional restrictions on lead shot and lead fishing tackle in National Parks, National Wildlife Refuges, and on public lands in 25 states. California passed its own regulation requiring the use of lead-free shot when hunting waterfowl (14 CCR § 507.1). Similar restrictions on lead shot and fishing tackle are in place in Canadian National Parks and National Wildlife Areas, in northern Japan, Great Britain, and parts of Europe.

Other than the regulations pertaining to lead shot, the federal government does not regulate the method of take by hunting, deferring to state regulations on federal lands. State and federal regulations are otherwise silent regarding lead in ammunition.

E. Alternative Ammunition

As readily seen from the available scientific information, lead poisoning is the most serious obstacle to the recovery of condors in California. The single biggest source of lead in the condor's environment is lead bullets and shot used by hunters. This section addresses the availability and performance of alternative ammunition that will not result in lead exposure to condors and other wildlife.

1. Availability and Performance of Alternative Bullets

For all but the smallest caliber bullets (those used for varmint hunting), non-lead ammunition is widely available. Currently available alternatives are either made completely of lead-free materials, such as copper, or designed such that a lead interior is protected from exposure upon impact. Other designs have been proposed and it is expected that the increase in demand will result in greater options of lead-free, non-toxic ammunition.[10]

As discussed more fully below, alternative bullets generally have equivalent, if not superior, performance when compared to their lead counterparts. Indeed, these bullets were originally designed for the "premium" market not because of concerns over lead poisoning but rather for their enhanced ballistic capabilities. A bullet's performance in flight is expressed in terms of its "ballistic coefficient," which is basically a measure of how streamlined a bullet is. The more streamlined the bullet, the higher the ballistic coefficient value, the better the velocity retention, and the less wind drift the bullet will experience (FSUCM 2004). A pointed and dense bullet will usually have a higher ballistic coefficient (that is, fly straighter for a longer distance) than a round and light

[10] For example, the U. S. Department of Defense, the largest single user of ammunition in the U. S., has recognized the toxic danger of lead ammunition and is in the process of developing lead-free alternatives through their "Green Bullet Program" (Richard 2003).

bullet. Most hunting bullets have a ballistic coefficient of between .180 and .550 (ODHA 2004).[11]

a. Copper Bullets

Currently there are a number of lead-free copper hunting bullets produced, at least one of which—the Barnes X Bullet—is widely available. The Barnes X is made out of copper, a material that is lighter and more rigid than lead. Barnes produces a number of X-type bullets, including the X, XLC, and Triple Shock X, in a wide variety of calibers suitable for hunting game such as deer, elk, pig, and coyote. In order to promote proper expansion, Barnes bullets are designed with a hollow point that is fluted so that the tip peels back to form a mushroom upon impact. Barnes bullets have a ballistic coefficient between .220 and .555, depending upon the caliber and cartridge used. Barnes also reports that its bullets retain close to 100% of their weight after hitting most targets. Thus, Barnes bullets are lead-free alternative ammunition that offers equivalent or superior performance to that of high-quality lead bullets.[12]

b. Jacketed Bullets with a Lead Core

Another type of alternative ammunition consists of bullets that contain a small lead core that is totally encased in another material and designed not to fragment upon impact. Winchester Fail Safe ammunition is such a bullet and is produced in a wide variety of calibers, including those generally used for hunting game such as elk, deer, hog and coyote. The Fail Safe consists of a steel-encased lead core with a hollow-pointed copper tip. The steel casing around the lead core is designed to prevent if from expanding or fragmenting upon impact. Consequently, the lead core should not be exposed. In discussing the Fail Safe, Fry and Maurer (2003) note that if the steel encased lead core was ingested by a condor it "should not result in dissolved lead in the stomach or blood stream," but they also recommend further testing to ensure that the Fail Safe performs as advertised. Winchester reports that the ballistic coefficient of its Fail Safe bullets ranges between .314 and .394, depending upon the caliber and cartridge used.[13]

c. Other Alternatives

Another alternative ammunition, composed of tungsten, tin, and bismuth ("TTB") is being developed by various ammunition manufacturers and the military has been experimenting with a so-called "green" bullet that relies on the same metals to replace

[11] In addition to its performance in flight, in order to be as effective as possible, a hunting bullet must both expand and penetrate. There are two schools of thought within the hunting world regarding penetration: The first is that the bullet should open rapidly, blowing apart and rapidly transferring all of its kinetic energy to the animal. This is what traditional thin-jacketed lead core bullets do. The second view favors a bullet that expands in a controlled manner, penetrating more completely and delivering both its mass and its kinetic energy in a concentrated fashion. This approach is exemplified by newer, higher performance bullets.

[12] Barnes Bullets, Inc. (http://www.barnesbullets.com/products.php).

[13] Winchester Ammunition (http://www.winchester.com/products/catalog/rifle.aspx).

lead (Mikko 1999).[14] However, recent tests have indicated that tungsten is water soluble and a potential surface and ground-water pollutant, which has caused the Department of Defense to rethink TTB technology (Beaven 2004).

2. Availability and Performance of Alternative Shot

In addition to alternative bullets, lead-free shotgun ammunition is also widely available on the market, largely as the result of federal regulations requiring its use while hunting for waterfowl (50 C.F.R. § 20.134). Shotguns, the dominant firearm used for waterfowl hunting, are also used for upland hunting of small game, such as squirrels, rabbits, and birds, and are occasionally even used for hunting larger game such as deer and pigs.

Commercially available nontoxic shotgun ammunition consists of shot composed either of steel, tungsten (including tungsten-iron, tungsten-nickel-iron, and tungsten polymers), bismuth, or tin (WFGA 2001). It should be noted, however, that non-toxic shot is not currently available for all gauges and pellet sizes, particularly larger gauge ammunition which may be popular with some upland bird or game hunters (WFGA 2001).

The use of nontoxic shot for hunting upland game is mandated on a variety of federal and state lands, and nontoxic shot is used by upland hunters across at least 1.33 million acres nationwide (WFGA 2001). For example, a number of individual National Wildlife Refuges require the use of nontoxic shot, as do a number of states such as South Dakota and Maine.[15]

The performance of nontoxic shot is also roughly equivalent to that of lead shot. Non-lead shot, particularly steel, is lighter than lead and thus tends to have reduced velocity and greater distances, whereas bismuth shot has a density almost equivalent to that of lead.

3. Potential Disadvantages of Alternative Ammunition

A number of potential concerns other than performance are often raised about alternative ammunition, including the potential for alternative metals (such as copper) to be toxic themselves, claims of increased barrel fouling and general firearm deterioration from the use of alternative ammunition, and cost. Each of these issues is addressed below.

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[14] Engineers at Oak Ridge National Laboratory (ORNL) are fabricating experimental bullets for the Army from powdered high density metals such as tungsten, mixed with softer metals such as tin and zinc.

[15] *See, e.g.*, Flint Hills National Wildlife Refuge (http://flinthills.fws.gov/), where nontoxic shells are required for all hunting except deer; Valentine National Wildlife Refuge (http://valentine.fws.gov/), where no lead shot is permitted; South Dakota Dept. of Game, Fish and Parks (http://www.sdgfp.info/Wildlife/hunting/Info/nontoxic.htm), where non-toxic shot is mandatory for small game hunting; and Maine Dept. of Inland Fisheries and Wildlife (Migratory Game Bird Hunting Schedule 2003), requiring the use of nontoxic shot for upland hunting on National Wildlife Refuges for all game other than deer or turkey and statewide for hunting of wild ducks, geese, brant, rails, or coots.

a. Copper Toxicity

One potential disadvantage of commercially available non-lead bullets is that currently available alternatives use copper, another potentially toxic metal, as a substitute for lead.[16] Copper, a naturally occurring metal, is a necessary nutritional element of most animals' diets. Copper is often stored in the liver and if enough copper is ingested it can be toxic to some species.[17] Fry and Maurer (2003) report that there are no data available on copper toxicity to avian wildlife and many birds show a high tolerance to copper. Turkey vultures seem particularly resistant to copper poisoning and can tolerate extremely large dietary doses of copper without a concomitant change in the level of copper in their blood (Risebrough 2001).[18] Thus, the available evidence indicates that copper is far less likely to be toxic to avian predators and scavengers than lead, though some potential for copper toxicity exists.[19]

b. Barrel Fouling

Virtually all types of ammunition cause barrel fouling in firearms. As a bullet travels through a barrel, it leaves a residue that "fouls" the barrel and can reduce shooting accuracy. Sporting rifles usually need barrel cleaning after a day of hunting or after shooting approximately 20-25 rounds. Top quality barrels may go longer than 25 rounds, while older and mass-produced barrels usually need cleaning more often (Levy 2001).

As a general rule of thumb, the softer the metal the more likely it is to adhere to the barrel and the more potential for fouling. Pure copper bullets are softer than traditional bullets with copper-alloy jackets and therefore more prone to fouling (Lilja 2002). On the other hand, the Fail Safe ammunition discussed above is covered with a copper-alloy and would therefore be expected to cause fouling similar to traditional bullets that are also encased in a copper-alloy. Factors other than metal softness also play a role. For example, the Barnes bullets are "heat treated" to reduce fouling and the Barnes Triple Shock X-Bullet has grooves in the shank of the bullet to further reduce friction and fouling. The grooves are intended to provide a pressure relief area for displaced copper to move to rather than being deposited in the barrel.

Barrel fouling is, however, fairly easy to remove with chemical or mild abrasive cleaning compounds, such as Sweets, Butch's, or Barnes Copper solvent (RSI 2004). The question then becomes how often a barrel needs cleaning. Manufacturers of ammunition make various claims about their particular bullets and why they cause less fouling than others, but such claims are difficult to substantiate. Indeed, there are some

[16] Non-toxic shotgun ammunition is not made of copper, so this concern is not an issue for shot.
[17] Ruminants, particularly sheep, seem to be the most susceptible to copper toxicity (Berger 1991). Ruminants, of course, would not plausibly intake copper ammunition from hunting carcasses.
[18] Risebrough (2001) concluded that turkey vultures may not be a good surrogate for condors because of their unusually high resistance to copper poisoning (see also Valenica et al. 1997).
[19] Until more research is conducted on toxicity of copper ammunition to wildlife species of concern, as the hunting community shifts to copper-based ammunition it may be important to continue encouraging hunters to bury gut-piles.

ammunition manufacturers, such as Swift Bullet Company, that now use pure copper jackets as opposed to the copper-alloy jackets, not to prevent lead contamination but because they believe the pure copper jackets offer overall performance advantages (Towsley and Keefe 2002).

c. General Deterioration

All hunting rifles deteriorate with use and it is not clear whether there are any significant differences between the effects of copper-alloy jacket bullets and pure copper bullets. Steel bullet jackets have a greater impact on the deterioration of barrels because steel is a harder metal than copper and its alloys. Some experienced hunters suggest that steel bullet jackets be fired only in certain types of barrels, such as chrome-moly barrels (Lilja 2002). Because pure copper is softer than typical copper-alloys, it may be surmised that pure copper bullets have less of an impact on rifle barrels, although we did not find any studies on this particular issue.[20]

d. Cost and Availability

Both Barnes and Winchester Fail Safe bullets are sold in the "premium" bullet market. Premium bullets are generally considered to be of a higher quality than "standard" or "medium" bullets used in hunting, but they are somewhat more expensive. The average cost of a Barnes X or Fail Safe bullet is about $25 - $30 a box, some $15 dollars more than the cheapest hunting bullets now available.[21] Of course, many hunters already use premium or medium grade bullets. However, mandating the use of non-lead bullets in condor habitat would impose some additional costs on some in the hunting community. Thus the Commission should explore options for defraying the costs to hunters from shifting to non-lead bullets, at least until lower cost alternatives are more widely available, as a means of accelerating compliance. However, it should be kept in mind that the incremental cost of alternative ammunition is typically a tiny fraction of the total that California hunters spend on their sport. According to the federal government, the average big game hunter in California spends just over $800 per hunting trip. Of that $800, approximately $173 dollars are spent on all "hunting equipment" (USDOI/DOC 2003).

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[20] The use of steel shotgun ammunition also may cause damage to older shotguns. However bismuth shot is softer than lead and can be used with all shotguns, regardless of age.

[21] Alternative shot is also more expensive than standard shotgun ammunition. While premium lead shot is approximately the same price as some steel shot, steel is generally more expensive than lead (Scheuhammer and Norris 1995). Other types of alternative shot are also more expensive than lead. For example, a box of ten 12 gauge, 3 inch, Hevishot non-lead shells retails for a suggested $18.49, while a box of 25 12 gauge, 3 inch, Winchester Supreme lead shells costs $26.60. *Compare* http://www.hevishot.com/shopping/storefront.html; *to* http://www.winchester.com/products/catalog/shotlist.aspx?use=6&gauge=12.

IV. AUTHORITY TO ACT

California's obligation to regulate "wildlife resources" within its boundaries is explicitly laid out in the California Fish and Game Code (CFGC § 1801):

> It is hereby declared to be the policy of the state to encourage the preservation, conservation, and maintenance of wildlife resources under the jurisdiction and influence of the state….
> …(c) To perpetuate all species of wildlife for their intrinsic and ecological values…
> …(e) To maintain diversified recreational uses of wildlife, including the sport of hunting, as proper uses of certain designated species of wildlife, subject to regulations consistent with *the maintenance of healthy, viable wildlife resources*, the public safety, and a quality outdoor experience. (emphasis added).

Prohibiting the use of toxic lead ammunition is precisely the type of regulation of hunting consistent with the maintenance of healthy, viable wildlife resources envisioned by this legal mandate.

Additionally, the State has the responsibility and full authority to promulgate a rule regulating hunting in habitat for endangered and threatened species such as the California condor and the bald eagle under the California Endangered Species Act (CESA Articles 2052 and 2055):

> The Legislature further finds and declares that it is the policy of this state to conserve, protect, restore, and enhance any endangered species or any threatened species and its habitat…. The Legislature further finds and declares that it is the policy of this state that all state agencies, boards, and *commissions* shall seek to conserve endangered species and threatened species and shall utilize their authority in furtherance of the purposes of this chapter. (emphasis added).

The State has further responsibility to prevent the take of Fully Protected species such as the California condor, bald eagle, and golden eagle under the California Fish and Game Code (CFGC § 3511(a)(1)):

> Except as provided in Section 2081.7, fully protected birds or parts thereof may not be taken or possessed at any time. No provision of this code or any other law shall be construed to authorize the issuance of permits or licenses to take any fully protected bird, and no permits or licenses heretofore issued shall have any force or effect for that purpose.

The Commission meets three times a year in even-numbered years to consider and adopt new regulations relating to mammals, and meets twice a year in even-numbered years for the consideration and adoption of regulations relating to game birds (*Id.* §§ 207 and 208). Aside from these regularly scheduled meetings, the Commission may adopt emergency regulations after holding at least one meeting. The Commission may adopt an emergency regulation if it determines that it is necessary for the immediate conservation, preservation, or protection of birds, mammals, reptiles, or fish (*Id*. § 240).

Because the adoption of an emergency regulation is necessary for the immediate conservation, preservation, and protection of the California condor, Petitioners request that the Commission place this request on the agenda for a discussion and action at the first Commission meeting for which it can be properly noticed pursuant to Cal. Gov. Code § 11346.1 and CFGC § 240. Petitioners request that the Commission act pursuant to its authority under and in accordance with the California Fish and Game Code, Article 200, *et seq*.

V. CONCLUSION

The continued use of lead ammunition poses a serious threat to avian scavengers and emergency action is required to reduce lead exposure to California condors in particular. Despite the accomplishments of the condor recovery program, the California condor remains dependent on recovery efforts for lead-free food, blood chelation therapy, and captive breeding to replace and increase its numbers. Although a variety of factors have contributed to the condor's plight throughout time, the single greatest factor preventing recovery of the species is the presence of lead in ingested bullets. The State has a legal responsibility to ensure that hunting is conducted in California in such a manner as to provide sufficient protection to the listed California condor and bald and golden eagles. Petitioners request that the State begin this process in accordance with the applicable provisions of the California Fish and Game Code.

Dated: December 16, 2004

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Jeff Miller
Center for Biological Diversity
On behalf of all petitioners

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