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CASE STUDY: THE MEXICAN WOLF

Abstract

The Mexican wolf (*Canis lupus baileyi*) is the southern-most occurring and most endangered subspecies of gray wolf (*Canis lupus*) in North America, historically occupying montane woodlands in the southwestern United States (U.S.) and central and northern Mexico. It was extirpated from the wild in the U.S. by private and government control campaigns and was listed as an endangered species in 1976. The Mexican Wolf Recovery Plan recommends the establishment and maintenance of a captive population and the re-establishment of a wild population. Captive propagation was initiated with 5 wild wolves captured in Mexico from 1977 to 1980. In 1995, two additional captive populations were determined to be pure through molecular genetic (DNA) analyses. Currently, there are 150 living wolves in the captive population; and none are known to exist in the wild. The U.S. Fish and Wildlife Service (USFWS) has proposed the reintroduction of a nonessential, experimental population of Mexican wolves. A draft Environmental Impact Statement addresses relevant issues and concerns associated with the proposal. There is broad public support for the recovery and preservation of the Mexican wolf. Most people affiliated with or sympathetic to the livestock industry are opposed. This case study demonstrates the diversity and complexity of scientific and policy issues involved in the conservation and restoration of large carnivores.

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Introduction

The Mexican wolf (*Canis lupus baileyi*) is the southern-most occurring, most genetically unique, and most endangered subspecies of gray wolf (*Canis lupus*) in North America (Parsons and Nicholopoulos, 1995 and García-Moreno et al., 1996). Gray wolves entered North America thousands of years ago by crossing the Bering Strait land bridge between Siberia and Alaska when the ocean level receded during the great "ice age." They gradually spread southward and eastward across the continent adapting, through natural selection, to new environments they encountered. Ultimately, gray wolves colonized nearly the entire content as far south as Mexico City. An exception was the southeastern portion of the United States, which was home to the red wolf (*Canis rufus*). Evolutionary selective pressures exerted by the unique environments they encountered resulted in physical and genetic differences used by taxonomists to differentiate gray wolf subspecies. While confusion and disagreement over North American gray wolf taxonomy persists (Brewster and Fritts, 1995), available data clearly support the conclusion that the Mexican wolf is a distinct subspecies (Nowak, 1995 and García-Moreno et al., 1996).

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Taxonomy and Historic Range

Hall and Kelson (1959), relying heavily on prior work of Young and Goldman (1944), described 24 subspecies of gray wolves in North America, five of which occurred in the southwestern United States and Mexico: *C. l. baileyi*, *C. l. mogollonensis*, *C. l. monstrabilis*, *C. l. nubilus*, and *C. l. youngi* (Figure 1). A taxonomic revision proposed by Bogan and Mehlhop (1983) lumped *C. l. mogollonensis* and *C. l. monstrabilis* into *C. l. baileyi*. In a recent reclassification of North American gray wolves, Nowak (1995) proposed reducing the original 24 named subspecies (Hall and Kelson, 1959) to five, of which *C. l. baileyi* is one. However, Nowak's reclassification differs from that proposed by Bogan and Mehlhop in that Nowak includes *C. l. mogollonensis* and *C. l. monstrabilis* with *C. l. nubilus*, not *C. l. baileyi*. It should be noted that no individual taxonomist or publication has "official" status or serves to rule on questions of mammalian taxonomy.

The classifications proposed by Hall and Kelson (1959), Bogan and Mehlhop (1983), and Nowak (1995) were based on comparisons of morphological characteristics, primarily skull measurements, and all concluded that *C. l. baileyi* is a morphologically distinct subspecies of gray wolf. Molecular genetic (DNA) analyses have identified distinct genetic attributes in Mexican wolves (García-Moreno et al., 1996, Hedrick, 1995, Wayne, et al., 1992, and S. Fain, pers. comm.). Thus, there appears to be clear consensus within the scientific community that *C. l. baileyi* is sufficiently distinct, both morphologically and genetically, to be taxonomically retained as a subspecies of the gray wolf. However, the lingering question of which formerly recognized subspecies (Hall and Kelson, 1959) belong to *C. l. baileyi* continues to confuse the delineation of the Mexican wolf's original distribution.

Requirements of the Endangered Species Act of 1973 (ESA) lead to the importance of delineating, as accurately as is possible, the original distribution of the Mexican wolf. Regulations for implementing the ESA state that "[t]he Secretary may designate as an experimental population a population of endangered or threatened species that has been or will be released into suitable natural habitat...within its probable historic range," [50 CFR 17.81 (a)] underlining added. The USFWS could be vulnerable to a legal challenge if it could be demonstrated that recovery efforts are being undertaken outside the subspecies' original range. For example, some people believe that areas proposed for reintroduction of Mexican wolves (see Figure 3) are outside that range. Thus, the taxonomic issues discussed above are inextricably linked to the discussion of original range below.

In the Mexican Wolf Recovery Plan (USFWS, 1982), the USFWS included the ranges of the former *C. l. mogollonensis* and *C. l. monstrabilis* in the range of *C. l. baileyi* according to the recommendations of Bogan and Mehlhop (1983). However, Nowak (1995) suggested that the original core geographical range of *C. l. baileyi* extended just north of the Gila River, which bisects the Gila National Forest (part of the Blue Range Wolf Recovery Area). Nowak (1995) did not describe the limits of the northeastern portion of his proposed range for the Mexican wolf, but the line on his map bisects the proposed White Sands Wolf Recovery Area then turns southeast through western Texas and enters Mexico just east of Big Bend National Park. Nowak (1995) speculated that individuals from the geographic range of *C. l. baileyi* historically dispersed into the range of wolf subspecies to the north, and that following the extermination of wolves in the southwestern U.S., Mexican wolves expanded their range to fill the void.

In reality, the boundaries between ranges of adjacent gray wolf subspecies were wide zones of intergradation where genetic mixing between subspecies occurred (Mech, 1970 and Brewster and Fritts, 1995). The width of these zones relates to the ability of this species to disperse. Gray wolves are capable of dispersing hundreds of kilometers, with the longest known dispersal exceeding 885 km (550 mi) (Fritts, 1983). Thus for gray wolves, these zones of subspecies intergradation were likely hundreds of miles wide.

In light of the above discussion and a recommendation from the Mexican Wolf Recovery Team, the USFWS has concluded that a realistic delineation of the original range of the Mexican wolf includes the most restrictive range assigned to *C. l. baileyi* (see Figure 1), plus a 322-km (200-mi) extension to the north and northwest of that area (Figure 2). This range delineation includes the ranges of *C. l. baileyi* as described by Young and Goldman (1944), Hall and Kelson (1959), and Nowak (1995); includes much of the expanded range resulting from the consolidation of subspecies proposed by Bogan and Mehlhop (1983); accommodates the range expansion of *C. l. baileyi* following extermination of adjacent wolf populations described by Nowak (1995); and is consistent with the dispersal capability of gray wolves. Figure 2 defines the "probable historic range" of *C. l. baileyi* for purposes of reintroducing Mexican wolves in the wild in accordance with provisions of the ESA and its regulations. This range includes portions of central and northern Mexico, western Texas, southern New Mexico, and southeastern and central Arizona.

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Habitat

The Mexican wolf preferred montane woodlands, presumably because of the favorable combination of cover, water, and prey availability. Most wolf collections came from pine, oak, and pinyon-juniper woodlands, and intervening or adjacent grasslands above 1,372 m (4,500 ft) in elevation (Brown, 1983). Wolves avoided desert scrub and semidesert grasslands, which provided little cover or water (Brown, 1983). Wooded riparian corridors were probably also used by Mexican wolves for travelling and hunting.

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Life History

Little is known of the natural history of the Mexican wolf. Some data were obtained by trappers employed by the Predatory Animal and Rodent Control Service (PARCS). Numbers, weights, and details were often embellished (Brown, 1983 and Gipson, 1995). Weights of wild Mexican wolves range from 25-45 kg (54-99 lbs) (McBride, 1980, Leopold, 1959, Young and Goldman, 1944). Adult Mexican wolves ranged from 140-170 cm (4.5-5.5 ft) in total length (nose to tail), and averaged 72-80 cm (28.5-31.5 in) in shoulder height. The Mexican wolf like most other North American gray wolves has a range of pelage colors and patterns; however, solid white or black Mexican wolves are not documented (Brown, 1983).

The Mexican wolf probably preyed primarily on white-tailed deer (*Odocoileus virginianus*) and mule deer (*O. hemionus*). Elk (*Cervus elaphus merriami*), pronghorn (*Antilocapra americana*), javelina (*Tayassu tajacu*), beaver (*Castor canadensis*), rabbits (*Sylvilagus sp.*), hares (*Lepus sp.*), and small mammals likely provided alternative prey; food habits are not well documented. As livestock numbers increased in the late 1800's and native ungulate populations concurrently declined through unregulated subsistence and market hunting, the Mexican wolf began to prey on livestock. Today, livestock numbers are significantly lower, and wild ungulate populations have been restored in many areas.

Predation methods of Mexican wolves differed from those of other large predators (e.g., mountain lions, black bears, and grizzly bears) in Southwestern ecosystems. Wolves pursue their prey by chasing, sometimes over long distances, and often hunt in groups; while other large predators hunt singly and usually rely on ambush or opportunistic encounters with their prey. Thus, the evolutionary influence of Mexican wolves on their prey was unique and was not replaced in their absence.

Bednarz (1988) suggested that Mexican wolves form small family groups of from two to eight members when not molested, but data supporting this belief are generally lacking. Most information obtained regarding free-ranging Mexican wolves was provided by trappers who most often targeted lone wolves. Occasionally, groups of wolves were taken together, but the intensive control activities undoubtedly affected the structure of wolf social units, and eliminated the basis for scientific determination of pack size and social structure. Likewise, most data obtained on the productivity of wild Mexican wolves was provided by people who dug young wolves from dens, usually to kill them (Brown, 1983).

McBride (1980) reported a mean litter size of 4.5 from 8 dens in Mexico. Mean litter size before parturition for 8 females was 6.8, indicating a degree of mortality during or after birth (McBride, 1980). The size of 86 litters of Mexican wolves born in captivity ranged from 1-9 with a mean of 4.6 (Siminski, 1996). Captive females usually come into estrous between mid-February and mid-March. Gestation averages 63 days, with parturition occurring in April and May.

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Population Status in the Wild

Wolves have inhabited the Southwest since the Pleistocene Epoch. Fossil remains have been reported from Arizona (Lindsay and Tessman, 1974) and New Mexico (Findley et al., 1975). Bednarz (1988) estimated 16.1 wolves per 1,000 km2 (386 mi2) or about 1,500 animals for the suitable habitat in New Mexico prior to control measures initiated by PARCS in 1915.

Many methods were used to exterminate Mexican wolves, including trapping with snares and steel leg hold traps, denning, shooting, and poisoning with sodium cyanide (used in the "coyote getter" device) and strychnine, arsenic, and compound 1080, which were placed in carcasses or other baits. Public and private bounties were paid. PARCS reported over 900 Mexican wolves killed in New Mexico and Arizona by government trappers or cooperators from 1915-1925, and it is believed that a greater number of wolves were killed for bounties from 1890 to 1915 (Brown, 1983).

The Mexican wolf is believed to be extirpated from the wild in the U.S. Bednarz (1988), utilizing a regression model, proposed 1942 as the estimated year of extirpation in New Mexico. McBride (1980) estimated that fewer than 50 Mexican wolves existed in the states of Chihuahua and Durango, Mexico, and speculated that no more than 50 adult breeding pairs existed in Mexico in 1978. The present status of wild populations in Mexico is unknown but thought to be much lower than McBride's estimates for 1978. Recent surveys in Mexico have not confirmed its presence in the wild (Carrera, 1994). It appears very unlikely that viable populations remain in Mexico, if any remain at all. The USFWS continues to receive unconfirmed reports of wolf sightings primarily from U.S./Mexico border areas of Arizona and New Mexico. These "wolves" could be Mexican wolves dispersing from Mexico or escaped or abandoned pet wolves, wolf-dog hybrids, or large dogs.

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Legal Status

The Mexican wolf subspecies was listed as endangered under provisions of the Endangered Species Act (ESA) in May 1976. In 1978, all North American gray wolves occurring south of the Canada/United States border were listed as endangered, except in northern Minnesota where they were listed as threatened. Provisions of the ESA make it illegal to "take" any wolf without a permit unless a human life is in danger. The USFWS has assigned a recovery priority of 3C to the endangered Mexican wolf. This means that it is an endangered subspecies with a high degree of threat and recovery potential whose recovery may conflict with some form of economic activity (Federal Register, Vol. 84, No. 184, 1983: 43104).

The gray wolf is also listed as an endangered species by the states of Arizona, New Mexico, and Texas.

The Mexican wolf is listed as an endangered species throughout Mexico. However, enforcement of this legal protection is problematic.

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Recovery Efforts

Under an agreement between the U.S. and Mexico, Roy McBride (Alpine, Texas) captured five Mexican wolves between 1977 and 1980 in Durango and Chihuahua. These wolves (four males and one pregnant female) were transferred to the Arizona-Sonora Desert Museum in Tucson, Arizona, to establish a captive breeding program.

The Mexican Wolf Recovery Team was formed by the USFWS in August 1979. The team prepared the Mexican Wolf Recovery Plan which was approved and signed by the Director of the USFWS and the Director General of the Dirección General de la Fauna Silvestre (Mexico) on September 15, 1982. Citing human demands for space and resources present in historical wolf habitat, the team concluded that there was "no possibility for complete delisting of the Mexican wolf" (USFWS, 1982:23). The unstated implication is that down-listing to a threatened status is the best that could be hoped for. The plan contains the following objective: "To conserve and ensure the survival of C. l. baileyi by maintaining a captive breeding program and re-establishing a viable, self-sustaining population of at least 100 Mexican wolves in the middle to high elevations of a 13,000 km2 (5,000 mi2) area within the Mexican wolf's historic range" (USFWS, 1982:23). The two key components of this objective are captive breeding and re-establishment of a wild population.

The recovery plan is being revised. Based on advances in conservation biology and the application of a population viability model (VORTEX, version 7), the current recovery objective for the Mexican wolf will be reviewed and revised. Specific goals for down-listing to a threatened status and de-listing the Mexican wolf will be established.

Given the natural and human-caused isolation of areas of suitable habitat for the Mexican wolf, a number of separate reintroductions will likely be required to ensure long-term conservation of the subspecies. Re-establishment efforts will most likely result in a metapopulation (two or more isolated subpopulations), which may require active management to ensure adequate gene flow among re-established subpopulations (Lande and Barrowclough, 1987).

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Captive Breeding Program

Between 1977 and 1980, five wolves (four males and one pregnant female) were live-captured in Durango and Chihuahua, Mexico, to establish a captive population of Mexican wolves called the "certified" lineage.

The captive breeding program for certified Mexican wolves was initiated at the Arizona-Sonora Desert Museum in Tucson, Arizona, with the delivery of the five wild-caught wolves beginning in 1977 and the birth of a litter of five pups by the captured pregnant female (Studbook Number 5) in 1978. The only female pup in this litter died at the age of 4 days. Two of the wild-caught males and the lone female later bred and produced offspring in captivity. In 1981 at the Wild Canid Survival and Research Center in Eureka, Missouri, female number 5 gave birth to her second litter in captivity (one male and three female pups). All four of these pups survived and reproduced. By 1983, the captive breeding program was firmly established with the birth of three litters totaling 15 pups (Siminski, 1996).

Based largely on the results of DNA studies, two additional lineages of captive Mexican wolves, one each in the U.S. and Mexico, were certified for inclusion in the official breeding program for Mexican wolves in July 1995 (Hedrick, 1995). The U.S. population is referred to as the Arizona-Sonora Desert Museum/Ghost Ranch (Ghost Ranch) lineage and the Mexican population is referred to as the Parque Zoológico de San Juan de Aragón (Aragón) lineage.

The Ghost Ranch lineage consists of 21 known animals, all descended from two founders. The original sire was live trapped in 1959 near Tumacacori, Arizona. The founding female was purchased as a pup in 1961 by a Canadian tourist in Yecora, Sonora, Mexico. A question remains as to whether it was born in the wild or in captivity (Ames, 1980).

The Aragón lineage consists of eight animals held at the Parque Zoológico de San Juan de Aragón in Mexico City. The origin of this population cannot be traced to the wild or to known founding animals (Lopez Islas and Vasquez Gonzales, 1991).

As of August 1996, the captive population of Mexican wolves consisted of 150 individuals held in 29 zoos and wildlife sanctuaries in the U.S. and Mexico. This population is the result of captive breeding from the three officially accepted lineages of Mexican wolves. There are 121 wolves in the certified lineage, 21 in the Ghost Ranch lineage, and 8 in the Aragon lineage. Twenty-four facilities hold 121 Mexican wolves in the U.S.; and five facilities hold 29 Mexican wolves in Mexico. Three Certified/Ghost Ranch and three certified/Aragon cross-lineage pairs have been established and are expected to produce pups in 1997.

Management of the captive population follows a Species Survival Plan (SSP) developed and implemented by the American Association of Zoos and Aquariums. The SSP Management Group includes an SSP Coordinator, studbook keeper, representatives from facilities holding Mexican wolves, experts on husbandry and small population genetics, and the USFWS's Mexican Wolf Recovery Coordinator. The SSP objective is to establish and maintain a captive population of at least 240 animals with a minimum of 17 breeding pairs (American Zoo and Aquarium Association, 1994). Computer models predict that at least 75% of the gene diversity of the founding wolves would be conserved for the next 50 years with a professionally-managed population of this size. Population managers attempt to maximize retention of the genetic diversity (number of different alleles or gene forms) of the seven wolves that founded the population. This is accomplished by equalizing founder representation and minimizing inbreeding throughout the population through deliberate mate selection. A detailed, computerized studbook tracks the pedigree of every member of the population. A sophisticated "computer dating" program is used to match wolves for breeding.

Some concern has been expressed over the limited genetic base (seven founders) of the captive population. With this few founders, a certain level of inbreeding cannot be avoided. However, no evidence of "inbreeding depression" (decrease in vigor, viability, or fecundity that may result from excessive inbreeding) has been detected in the population (Hedrick 1995). The recent inclusion of two additional breeding lines will increase gene diversity and further reduce the likelihood of inbreeding depression in the population.

Recent analyses of allele frequencies at ten nuclear microsatellite loci (gene locations) in Mexican wolves from the three different lineages, other gray wolves, red wolves, coyotes, and domestic dogs provide the most definitive information on the ancestry and genetic purity of the three captive wolf lineages (García-Moreno et al., 1996 and Hedrick, 1995). From these and other studies, the Genetics

Committee of the Mexican Wolf Recovery Team concluded that wolves in the three lineages are all Mexican wolves and that there is no indication of any past cross-breeding with coyotes, dogs, or northern gray wolves (Hedrick, 1995). These studies also provided convincing evidence that two of the four founders of the certified lineage were probably mother and son, reducing the number of unrelated founders for this population to three. Thus the total captive population of Mexican wolves stems from seven founders. Captive breeding efforts truly have rescued this endangered subspecies from the brink of extinction.

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Re-establishment of Wild Populations

The USFWS is constructing a six-pen wolf management facility on the Sevilleta National Wildlife Refuge near Socorro, New Mexico. The purposes of this facility are to provide needed space for captive Mexican wolves, to provide greater flexibility for managing the captive population, and, if reintroduction is approved, to foster desirable attributes in wolves selected for release to the wild. Wolves will not be released from these pens onto the Sevilleta National Wildlife Refuge.

Reintroduction of captive-raised Mexican wolves to establish a wild population of about 100 wolves has been proposed (USFWS 1995). If approved, about five family groups (two groups per year) of surplus captive-raised Mexican wolves would be "soft released" into the White Sands Wolf Recovery Area (WSWRA) in south-central New Mexico or about 15 family groups (three groups per year) would be soft released into the Blue Range Wolf Recovery Area (BRWRA) in east-central Arizona and west-central New Mexico (Figure 3). Both areas could eventually be used if feasible and necessary to achieve the 100-wolf population objective. Continued population growth would result from natural reproduction achieving a final self-sustaining population of about 100 free-ranging wild Mexican wolves in 8-10 years if the BRWRA is used; about 20 wolves in 3 years if the WSWRA is used; and about 120 wolves if both areas are used.

The Blue Range Wolf Recovery Area includes all of the Apache and Gila National Forests in east-central Arizona and west-central New Mexico, encompassing about 17,700 km2 (6,850 mi2) (Figure 3). Elevations range from under 1,200 m (4,000 ft) in the semi-desert lowlands and along the San Francisco River to 3,350 m (11,000 ft) on Mount Baldy, Escudilla Mountain, and the Mogollon Mountains. Vegetation varies from grasses and shrubs in the lowest areas; pinyon, juniper, and evergreen oaks in the foothills at low to middle elevations; and mixed conifer stands at higher elevations. Open grassy meadows occur throughout, especially in the northern and higher elevation areas. Water is abundant in natural springs, streams, and rivers. Wild ungulate species include white-tailed deer, mule deer, elk, pronghorn, bighorn sheep (*Ovis canadensis*), and javelina. The area supports an estimated 57,000 deer and 16,000 elk. About 82,600 head of cattle were permitted to graze on 69% of the area in 1993, although actual numbers were probably lower. Other prevalent uses include forestry, mining, and various forms of outdoor recreation. The entire area is open to public use.

The White Sands Wolf Recovery Area includes all of the White Sands Missile Range, Holloman Air Force Base, White Sands National Monument, San Andres National Wildlife Refuge, Jornada Experimental Range and a strip of mostly Bureau of Land Management and State of New Mexico lands west of the missile range. It encompasses the San Andres and Oscura Mountains and portions of the

Tularosa Basin and the Jornada del Muerto. The White Sands Wolf Recovery Area contains about 10,400 km2 (4,000 mi2) (Figure 3). Elevations range from around 1,200 m (4,000 ft) in the desert basins to 2,700 m (9,000 ft) in the San Andres Mountains. Vegetation varies from grasses and shrubs in the basins and lower foothills; pinyon and juniper above 6,000 feet; to a small stand of ponderosa pine on Salinas Peak in the San Andres Mountains. Water is present at several permanent and intermittent springs and artificial water sources. Native wild ungulate species present include mule deer, pronghorn, and desert bighorn sheep (*Ovis canadensis mexicana*). Feral horses and introduced gemsbok (*Oryx gazella*) are also present. The area supports an estimated 7,500 mule deer and 1,700 gemsbok; other ungulates occur in very limited numbers. About 2,100 head of cattle graze on the area west of White Sands Missile Range. The missile range is not open to grazing by domestic livestock or to general public use. The most prevalent uses are military testing and training.

A "soft release" involves placing wolves in on-site pens for 2-6 months prior to their release. This procedure allows the wolves to acclimate to and learn to recognize the release area and reduces tendencies to return to their previous home. While in the pens, wolves would be fed carcasses (e.g., road kills) of native prey species. Additional carcasses would be left near the pen following release until the wolves acquire adequate hunting skills. The soft release procedure has worked well in the red wolf reintroduction program in North Carolina and the reintroduction of gray wolves to Yellowstone National Park.

The USFWS will designate the released wolves and their progeny as one "nonessential, experimental population" under provisions of section 10(j) of the ESA. The USFWS believes that this designation will provide necessary management flexibility for addressing potential wolf-human conflicts, especially livestock depredation. A nonessential, experimental population must be established by a federal regulation which defines the boundaries of the population and sets forth special rules for its management and protection. Special rules usually allow for more liberal legal "taking". (The term "take" means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct of members of the experimental population than would be allowed under the ESA for endangered species.) However, the ESA requires that the regulation establishing the experimental population and the special rules include a finding by the Secretary of the Interior that the proposed release will "further the conservation of the species" [50 CFR 17.81(b)].

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Litigation

Few controversial endangered species recovery projects escape litigation, and Mexican wolf recovery is no exception. In April 1990, a coalition of regional and national environmental organizations filed suit against the departments of the Interior and Defense alleging the agencies' failure to implement provisions of the ESA (Wolf Action Group, et al. v. United States, Civil Action No. CIV-90-0390-HB, U.S. District Court, New Mexico). The Plaintiffs claimed that the USFWS had failed to implement the Mexican Wolf Recovery Plan as required by section 4(f)(1) of the ESA, especially the plan's recommendation for the reestablishment of a wild population of Mexican wolves. The Department of Defense was charged with not utilizing their authority to further the purposes of the ESA by "carrying out programs for the conservation of endangered species" as required under section 7(a)(1) of the act. The U.S. Army White Sands Missile Range (WSMR) was being considered by the USFWS as a potential Mexican wolf reintroduction area when the Army withdrew it from further consideration in 1987. The WSMR Commander was responding to a USFWS regional policy of not reintroducing wolves on any area where the State game and fish department or land management agency objected. The plaintiffs termed this policy the granting of "veto power" over wolf recovery by the USFWS to the States and Federal land management agencies; and they claimed that the USFWS had violated the ESA by establishing this policy.

The litigants negotiated a stipulated settlement agreement in 1993, wherein the USFWS agreed to implement the Mexican Wolf Recovery Plan as expeditiously as possible. The USFWS also agreed to expedite completion of the National Environmental Policy Act (NEPA) process for its proposal to reintroduce Mexican wolves to the wild, which would consider an array of reintroduction sites, including the WSMR.

Shortly after the plaintiffs issued their notice of intent to sue in 1990, the Army reversed its decision to withdraw WSMR from consideration as a wolf reintroduction area. In October 1990, the USFWS hired a full-time Mexican Wolf Recovery Coordinator to expedite implementation of the Mexican Wolf Recovery Plan; and in early 1991, a general plan for reintroducing Mexican wolves to the wild was developed by the USFWS.

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National Environmental Policy Act Compliance

Compliance with applicable laws and regulations is required before wolves can be released. The most notable and rigorous of these is the National Environmental Policy Act (NEPA), which requires full evaluation and disclosure of anticipated environmental effects of a proposed Federal action and alternative courses of action prior to any decision to implement a proposal. NEPA also requires Federal agencies to seek ways to mitigate potential adverse affects of proposed actions. In order to comply with the provisions of NEPA, the USFWS began to collect public input for the preparation of an Environmental Impact Statement (EIS) on the proposed reintroduction plan in April 1991. Four public "scoping" meetings were held prior to the preparation of a draft EIS by an interagency, interdisciplinary team in June 1995. Fourteen public open-house meetings and three formal public hearings were held to receive public comments on the draft EIS. Nearly 18,000 comments or opinions were received, reviewed by the USFWS, and will be responded to in the final EIS, which is expected to be released in the fall of 1996.

A "Proposed Action" (described above) and three additional alternatives, including the required "no action" alternative, are presented in the draft EIS. For each alternative, potential impacts are identified and analyzed for the following topics: wild prey of wolves, hunting, livestock, predator control programs, governmental policies and plans, land use, military activities, recreation, and regional economies. Mitigation of potentially adverse effects is achieved primarily through the nonessential, experimental designation and its accompanying special rule. The proposed special rule establishes boundaries beyond which wolves will be captured and returned (see Figure 3); allows unavoidable, unintentional take; prohibits land use restrictions for wolf recovery on private and tribal lands; limits land use restrictions on public lands to 1-mile zones around release pens, dens, and rendezvous (pup rearing) sites, when necessary; allows the taking of wolves that are attacking livestock on private lands; allows noninjurious harassing of wolves near people, livestock, pets, and buildings; allows for the removal of problem or nuisance wolves; allows for capture and removal of wolves that prey on livestock; allows agencies to manage wolves for purposes authorized by the USFWS; limits potentially lethal animal damage control activities in areas occupied by wolves; and prohibits intentional taking of Mexican wolves, except as authorized by the rule. The Defenders of Wildlife, a national wildlife conservation organization, has agreed to reimburse livestock owners at fair market value for livestock killed by Mexican wolves.

The USFWS (1995) concludes that implementation of the Proposed Action set forth in the draft EIS would not result in major impacts.

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Socio-political Aspects

Public support for Mexican wolf recovery is strong and broad-based.

A poll conducted in 1995 (Duda and Young, 1995), showed that, statewide, about 60% of New Mexico residents supported reintroduction of Mexican wolves; while 22-25% opposed it, depending on the location (Arizona versus New Mexico, respectively). In the four primarily rural counties in the proposed release areas, about 50% of residents polled supported reintroduction, while about 32% opposed it. Biggs (1988) found that 79% of New Mexico residents, statewide, supported Mexican wolf reintroduction into New Mexico, while 79% of ranchers opposed it. Biggs (1988) also found that 21% of ranchers polled supported wolf reintroduction. A majority of statewide and rural Arizona residents also support reintroduction of Mexican wolves into its former forest and mountain habitats in Arizona (Johnson 1990).

Despite demonstrated public support, most elected and appointed officials who have stated their position oppose Mexican wolf reintroduction. This includes the governors of both New Mexico and Arizona, the Director of the New Mexico Department of Game and Fish, and the New Mexico Game and Fish Commission. The Arizona Game and Fish Department and Commission support a controlled experimental release on White Sands Missile Range, before they would consider endorsing a release in Arizona.

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Conclusions

The Mexican wolf is a unique life form that historically contributed to the overall biological diversity and ecological functioning of Southwestern ecosystems and the continued evolution of species it preyed upon. Deliberate eradication efforts driven by the politics of the late 1800s and early 1900s nearly caused the extinction of the Mexican wolf. Politics of the late 1900s provide hope for the preservation of the unique mix of genes molded by thousands of years of evolutionary pressure that form what we now recognize as the Mexican wolf and the restoration of its unique role in the ecosystem.

State-of-the-art science and conservation biology principles have been applied to resolve taxonomic identity and genetic purity questions and to produce and maintain a genetically and physically healthy population of captive Mexican wolves. The cooperation of numerous zoos and wildlife sanctuaries throughout the United States and Mexico is critical to the success of the captive breeding effort.

Socio-political aspects of Mexican wolf recovery are complex and public opinion is strongly divided, with proponents out-numbering opposers by about 2 to 1. Positions of elected officials often run counter to the opinion of a majority of their constituents, suggesting influences by special interests or a lack of knowledge or accurate information on the subject.

The proposal to reintroduce Mexican wolves to the wild is responsive to the recovery needs of the Mexican wolf and the concerns of the interested public, special interest organizations, elected officials, government agencies, and people who may be adversely affected by the wolf's return. Mitigation provisions reduce potentially adverse effects to the extent that no significant, adverse impacts are predicted to result from the reintroduction of Mexican wolves.

The are no known biological obstacles to Mexican wolf recovery. Suitable, genetically surplus animals from the captive population are available for reintroduction and suitable reintroduction areas exist. The successful reintroduction of red wolves in North Carolina demonstrated that captive-raised wolves can readily adapt to a wild environment. The successful reintroduction of northern gray wolves to Yellowstone National Park and central Idaho demonstrated that socio-political obstacles to wolf recovery are not insurmountable.

The fate of the Mexican wolf hangs on the decision of the Secretary of the Interior and the outcome of the litigation that will inevitably follow.

Earlier authors have doomed the Mexican wolf to extinction or permanent life in captivity (Brown, 1983; Burbank, 1990). However, a strong tide of public support for restoration of predators to their native ecosystems has resulted in the re-establishment of red wolves, northern gray wolves, bald eagles, peregrine falcons, sea otters, and black-footed ferrets to portions of their former ranges. Perhaps the Mexican wolf will also be given the opportunity to resume its unique ecological role in the southwestern U.S.

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Literature Cited

Ames, N. 1980. Mexican wolves in captivity: A review of the lineage originating in the 1960s at the Arizona-Sonora Desert Museum. Unpublished Report. U.S. Fish and Wildlife Service, Albuquerque, New Mexico.

American Zoo and Aquarium Association. 1994. The 1994 Mexican wolf SSP master plan. Compiled by D.P. Siminski, Arizona-Sonora Desert Museum, Tucson, AZ. 57 pp.

Bednarz, J. A. 1988. The Mexican wolf: Biology, history, and prospects for reestablishment in New Mexico. Endangered Species Report 18. U.S. Fish and Wildlife Service, Albuquerque, New Mexico. 70pp.

Biggs, J. R. 1988. Reintroduction of the Mexican wolf into New Mexico an attitude survey. M.S. Thesis, New Mexico State University. 66 pp.

Bogan, M. A., and P. Mehlhop. 1983. Systematic relationships of gray wolves (Canis lupus) in southwestern North America. Occasional papers of the Museum of Southwestern Biology No. 1. 21 pp.

Brewster, W.G. and S. H. Fritts. 1995. Taxonomy and genetics of the gray wolf in western North America: a review. Pages 353-374 in L.N. Carbyn, S.H. Fritts and D.R. Seip, eds. Ecology and conservation of wolves in a changing world. Canadian Circumpolar Institute, Edmonton, Alberta, Occasional Publication No. 35. 642 pp.

Brown, D. E. 1983. The wolf in the southwest. University of Arizona Press, Tucson, Arizona. 195 pp.

Burbank, J. C. 1990. Vanishing lobo. Johnson Publishing Company, Boulder, Colorado. 208 pp.

Carrera, J. 1994. Mexican wolf recovery program. Annual Report. PROFAUNA, A.C. Saltillo, Coahuila, Mexico. 10 pp.

Duda, M. D. and K. C. Young. 1995. New Mexico residents' opinions toward Mexican wolf reintroduction. Contract Report for League of Women Voters of New Mexico. Responsive Management, Harrisonburg, Virginia. 75 pp.

Findley, J. S., A. H. Harris, D. E. Wilson, and C. Jones. 1975. Mammals of New Mexico. University of New Mexico Press, Albuquerque, New Mexico. 360 pp.

Fritts, S. H. 1983. Record dispersal by a wolf from Minnesota. J. Mammal. 64(1): 166-167.

García-Moreno, J., M. D. Matocq, M. S. Roy, E. Geffen, and R. K. Wayne. 1996. Relationships and genetic purity of the endangered Mexican wolf based on analysis of microsatellite loci. Conservation Biology 10(2):376-389.

Gipson, P. 1995. Wolves and wolf literature: a credibility gap. Pages 345-353 in McIntyre, R., ed. The war against the wolf: America's campaign to exterminate the wolf. Voyager Press, Inc., Stillwater, Oklahoma. 495 pp.

Hall, R.E. and K.R. Kelson. 1959. The mammals of North America. The Ronald Press Company, New York. 1083pp.

Hedrick, P. 1995. Genetic evaluation of the three captive Mexican wolf lineages and consequent recommendations. Unpublished Report of Mexican Wolf Recovery Team Genetics Committee to U.S. Fish and Wildlife Service, Albuquerque, New Mexico. 23 pp.

Johnson, T. B. 1990. Preliminary results of a public opinion survey of Arizona residents and interest groups about the Mexican wolf. Unpublished Report. Arizona Game and Fish Department, Phoenix, Arizona. 58pp.

Lande, R. and G. F. Barrowclough. 1987. Effective population size, genetic variation, and their use in population management. <u>In</u> Viable Populations for Conservation. M. E. Soulé ed, Cambridge University Press, New York. 189pp.

Leopold, A. S. 1959. Wildlife of Mexico: The game birds and mammals. Univ. of California Press, Berkeley, California.

Lindsay, E. H. and N. T. Tessman. 1974. Cenozoic vertebrate localities and faunas in Arizona. Journal of the Arizona Academy of Science 9:3-24.

G. Lopez Islas and C.B. Vasquez Gonzales. 1991. Linaje de lobos Mexicanos "San Juan de Aragon": Historia, evidencias de su authenticidad y posibilidad de certificacion. Unpublished Report. Parque Zoológico de San Juan de Aragón, Mexico City.

McBride, R. T. 1980. The Mexican Wolf (<u>Canis</u> <u>lupus</u> <u>baileyi</u>): A historical review and observations on its status and distribution. Endangered Species Report 8, U.S. Fish and Wildlife Service, Albuquerque, New Mexico. 38 pp.

Mech, L.D. 1970. The wolf: the ecology and behavior of an endangered species. Natural History Press. Doubleday Publ. Co., N.Y. 380 pp.

Nowak, R.M. 1995. Another look at wolf taxonomy. Pages 375-397 <u>in</u> L.N. Carbyn, S.H. Fritts and D.R. Seip, eds. Ecology and conservation of wolves in a changing world. Canadian Circumpolar Institute, Edmonton, Alberta, Occasional Publication No. 35. 642 pp.

Parsons, D. P. and J. E. Nicholopoulos. 1995. The status of the Mexican gray wolf. Pages 141-146 <u>in</u> L.N. Carbyn, S.H. Fritts and D.R. Seip, eds. Ecology and conservation of wolves in a changing world. Canadian Circumpolar Institute, Edmonton, Alberta, Occasional Publication No. 35. 642 pp.

Siminski, D. P. 1996. International studbook for the Mexican gray wolf (<u>Canis</u> <u>lupus</u> <u>baileyi</u>). Arizona-Sonora Desert Museum, Tucson, Arizona.

U.S. Fish and Wildlife Service. 1982. Mexican wolf recovery plan. U.S. Fish and Wildlife Service, Albuquerque, New Mexico. 103 pp.

U.S. Fish and Wildlife Service. 1995. The reintroduction of the Mexican wolf within its historic range in the United States. Draft Environmental Impact Statement. U.S. Fish and Wildlife Service, Albuquerque, New Mexico.

Wayne, R. K., N. Lehman, M. W. Allard, and R. L. Honeycutt. 1992. Mitochondrial DNA variability of the gray wolf: Genetic consequences of population decline and habitat fragmentation. Conservation Biology 6(4):559-569

Young, S. P. and E. A. Goldman. 1944. The Wolves of North America. The American Wildlife Institute, Washington, D.C. 632 pp.

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