

Historical occurrence and distribution of desert bighorn sheep in Chihuahua, Mexico

James R. Heffelfinger¹ and Enrique Marquez-Muñoz²

¹ Arizona Game and Fish Department
555 N. Greasewood Road, Tucson, AZ 85745, USA

² 606 Cipres Street, Chihuahua, Chihuahua, Mexico 31160

Abstract

Desert bighorn sheep were historically found in many rugged and arid desert mountain ranges throughout the American Southwest and northern Mexico. Their affinity for remote and rugged ranges resulted in relatively little recorded information about their status and distribution in Chihuahua, Mexico. We identified 11 areas of historical distribution comprising 23 different mountain ranges. Other mountain ranges probably supported desert bighorn sheep historically, although we were unable to find supporting evidence. Some of the sites we located probably experienced sporadic exchange of individuals as is typical in bighorn sheep metapopulations today. Desert bighorn sheep in Chihuahua were originally found in a chain of mountain ranges oriented in a northwest to southeast direction through the state. Most of these populations were extirpated and only 2 subpopulations may have persisted; 1 in the southeast along the border with Coahuila and another in the northwest adjacent to the international border with New Mexico. Desert bighorn sheep continue to move into this latter area from New Mexico following translocations to the southwestern part of that state. We [EMM, personal observation] saw sheep in the Sierra San Francisco in 1963, but there are no confirmed records of wild desert bighorn sheep in Chihuahua after the mid-1970s. The key to restoring desert bighorn sheep in Chihuahua is to identify historical distributions and evaluate the remaining suitable ranges. These ranges can be prioritized and desert bighorn sheep can be released directly into the areas that hold the highest probability for success.

Key Words Chihuahua, Desert Bighorn Sheep, petroglyphs, *Ovis canadensis*, restoration.

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Historically, desert bighorn sheep (*Ovis canadensis mexicana*) were widely distributed throughout southwestern North America (Clark 1978). Within this wide distribution, they were found in areas of arid and extremely rugged terrain (Sheldon 1925). Their reliance on these specific habitat features relegated them to isolated

desert mountain ranges. This spatial discontinuity left them vulnerable to decimating factors in the last half of the 1800s. After Europeans moved into the southwestern United States and northern Mexico, desert bighorn sheep suffered from intensive overgrazing by livestock (Sandoval 1985, Holechek et al. 1998),

disease (Krausman et al. 1999), drought (Bahre 1991), and unregulated hunting (Townsend 1903, Leopold 1959:528, Monson and Sumner 1980:74).

Excessive forage use and chronic overgrazing were exacerbated by regional drought (Bahre 1991). This would probably have dramatically reduced the nutritional base of desert bighorn sheep populations and contributed to submaintenance recruitment and higher mortality of adults. In addition, diseases transmitted by domestic sheep and goats would have been devastating in areas where those animals were sympatric with bighorn sheep. Desert bighorn sheep have a long history of exposure to domestic livestock (including domestic sheep) which were introduced over 460 years ago (Holechek et al. 1998:49). Despite this long coexistence, there is no evidence wild sheep have developed an immunity to the diseases of domestic sheep and goats.

Mexico passed legislation as early as 1894 restricting hunting wild game (Federal Forest Law). However, like the United States at that time, it lacked financial resources to provide enforcement of those laws (Leopold 1959). The establishment of the Departamento de Caza y Pesca (Department of Game and Fish) in 1916 mirrored similar developments north of the U. S.-Mexico border at that time and provided the infrastructure (but still not the funding) to administer wildlife conservation.

The Federal Aid in Wildlife Restoration Act of 1937 initiated funding for research and management in the USA, but these benefits did not extend south of the border. In 1940 the first game law was passed (Ley de Caza), establishing a legal foundation for wildlife administration in Mexico. Still, with inadequate enforcement of laws, desert bighorn sheep in the arid mountains of Chihuahua declined and were finally extirpated altogether (Leopold 1959).

Sheldon (1925:173) estimated at least 2,000 desert bighorn sheep occupied the state of Chihuahua in the 1920s. Davila (1960) believed desert bighorn sheep were extirpated by the 1960s, however, we [EMM, personal observation] documented desert bighorn sheep in Sierra San Francisco and Sierra el Diablo in southeastern Chihuahua and the Sierra los Borregos in the northwest in 1963–1965. Other sources suggested that by the mid-1970s, there were still about 50 desert bighorn sheep remaining in Chihuahua (Trefethen 1975, Monson and Sumner 1980). By about 1970, wild desert bighorn sheep were probably extirpated from Chihuahua. The only free-ranging desert bighorn sheep in Chihuahua in the last 20 years are those that occasionally enter the state from southwestern New Mexico.

In the absence of population surveys, presence-absence information from individuals in northern Chihuahua is available to document where desert bighorn sheep historically occurred. The first step of a reestablishment program is a consistent and comprehensive evaluation of remaining potential habitat. Historical occurrence is an important criterion to be considered when evaluating the suitability and prioritization of desert bighorn sheep habitat for population reestablishment (Brown 1983, Wakeling and Miller 1990, Cunningham 1993).

Historical bighorn information used in this summary is derived primarily from experienced hunters who spent their lives working and hunting in the mountain ranges of Chihuahua, as well as published accounts, archaeological records, rock art, and petroglyphs (Figure 1). Other mountain ranges not discussed here were inhabited by bighorn sheep, at least seasonally. The only records of occurrence included in this paper are those based on specimens collected and those confirmed personally [EMM, personal

observation]. In many cases, mountain ranges were grouped together as 1 historical location if their proximity indicates they supported 1 panmictic population. There probably was some intermittent genetic exchange between some historical locations.

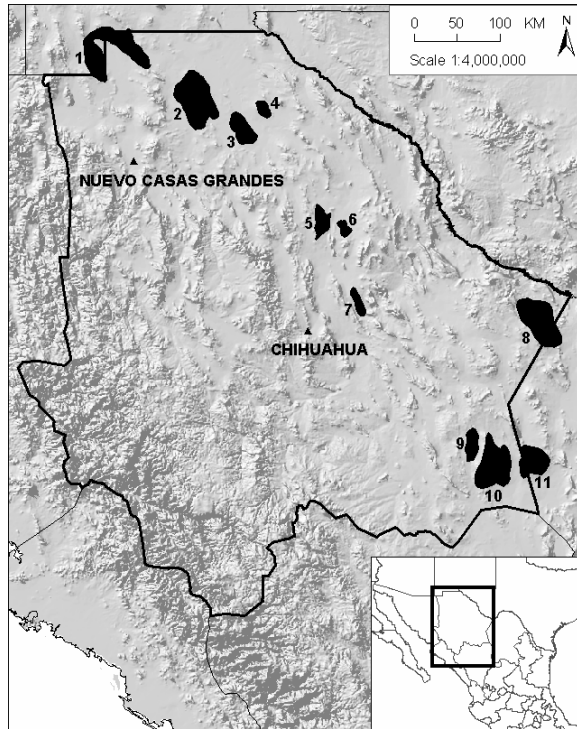


Figure 1. Historical sites where desert bighorn sheep have been documented in the state of Chihuahua.

Historical Distribution

(1) *El Chino [=Cerro Chino], Sierra Boca Grande, Sierra Alta, and Sierra Rica (including interchange of desert bighorn sheep with Big Hatchet, Alamo Hueco, and Dog mountains in southern New Mexico).*—This area near the U.S.-Mexico boundary has historically been a metapopulation of desert bighorn sheep moving between several interconnected mountain ranges. These movements included interchange between the Big Hatchet and Alamo Hueco mountains in the southern bootheel of New Mexico and the

desert mountains in extreme northern Chihuahua.

The history of bighorn in northern Chihuahua's El Chino, Sierra Boca Grande, Sierra Alta, and Sierra Rica mountains is fairly well documented. Desert bighorn sheep occupied these mountains about 100 years ago. Townsend (1903) hunted desert bighorn sheep in the mountains near Cerro Chino in February 1902 to obtain desert bighorn sheep for museums in the East. This collecting trip came only 1 year after the desert bighorn sheep was described as a separate taxonomic entity (Merriam 1901). After about 2 weeks of hunting, Townsend and his hunting party collected at least 6 desert bighorn sheep (skull and skin of 4 males and 2 females) that were then sent to the American Museum of Natural History (AMNH #17952–17957) in New York.

Movement of desert bighorn sheep between northern Chihuahua and the Big Hatchet-Alamo Hueco mountains of New Mexico has been documented (Gross 1960). Anderson (1972:394) reported that in 1966 desert bighorn sheep were moving among these mountains across the international boundary. Mearns (1907) mentions a personal observation of 6 desert bighorn sheep and other reports of desert bighorn sheep in the Big Hatchet Mountains of New Mexico in the 1890s. They were apparently still present, but in decline when E. A. Goldman visited in 1908 (Bailey 1931:21). The desert bighorn sheep population in the Big Hatchets of New Mexico were estimated to number as high as 300 prior to the 1950s (Gordon 1957), but surveys were not systematic at that time and probably represent mere guesses. Gross (1960) reported this herd had declined to fewer than 25 desert bighorn sheep by 1960. Desert bighorn sheep were translocated from a captive New Mexico herd at Red Rock into the Big Hatchet Mountains in 1979 ($n = 14$) and 1982 ($n = 18$; Fisher 1995). Currently,

fewer than 20 desert bighorn sheep inhabit the Big Hatchets and not more than 25 live in the Little Hatchets (E. Rominger, New Mexico Department of Game and Fish, personal communication).

Mearns (1907) reported that desert bighorn sheep were common in the Alamo Huecos in 1893 and that he found many horns from dead desert bighorn sheep (U.S. National Museum-National Museum of Natural History [USNM] 63161) in this mountain range, which was then referred to as the Dog Mountains. A mature male was also killed near the ranch house at Dog Spring in 1893 (USNM 36332). To bolster the population, the Alamo Hueco Mountains received a translocation of 21 desert bighorn sheep from New Mexico's Red Rock facility in 1986 (Fisher 1995). The last desert bighorn sheep was observed in the Alamo Huecos in 2000, and it is believed that this population was extirpated by 2001 (E. Rominger, New Mexico Department of Game and Fish, personal communication). There may be some rams from the Big Hatchets that travel to the Alamo Huecos, but no reports of ewes spending time there.

These historical movements across the international boundary have continued into recent years. Several desert bighorn sheep which were reestablished in the mountains in New Mexico have been harvested in Northern Chihuahua. In 1997–1998, a ram was harvested in Ascension County, Chihuahua about 24 km south of the Alamo Hueco Mountains. This ram unofficially scored 161 Boone and Crockett points and carried a Telonics radiocollar (Mesa, Arizona). This ram was originally moved from the Red Rock captive facility in New Mexico and released in the Big Hatchet Mountains in 1997 (E. Rominger, New Mexico Department of Game and Fish, personal communication). This animal (Figure 2) most likely followed the Alamo

Huecos-Dog Mountains into Chihuahua before being harvested.



Figure 2. Ram killed in Ascension County, Chihuahua in 1997 after moving south from southern New Mexico.

There are also reports of 3–4 other desert bighorn sheep being harvested in the last decade just south of the international border in the same general area. One of these desert bighorn sheep was a 5-year-old ram taken on the Las Lilas Ranch. Another report was of a 4-year-old taken in 1996 just south of the Alamo Huecos that unofficially scored about 155 Boone and Crockett points. The horns of this ram are currently on a ranch in the mountains of Chihuahua where the hunter moved after killing it. One other ram was harvested south of El Berrendo (Antelope Wells) that scored 155–160 Boone and Crockett points and was reported to have had a radiocollar, but the frequency is unknown.

(2) *Lago de Santa Maria, Sierra San Blas, Sierra la Nariz, Sierra Los Borregos, and Rincon de Chihuahua.*—This area surrounding Lago de Santa Maria (Lake Santa Maria) has always been famous as a place to find desert bighorn sheep. It was here in 1899 that naturalists E. W. Nelson and his assistant E. A. Goldman collected 8 specimens that were deposited in the U.S. National Museum (USNM 99339–99346; Figure 3). From these specimens, Merriam (1901) selected 1 as the type specimen to

describe the Mexican desert bighorn sheep as being different from the Rocky Mountain bighorn sheep (*Ovis canadensis canadensis*).



Figure 3. One of the desert bighorn sheep (USNM 99344) shot by Nelson and Goldman in the Lago de Santa Maria Mountains in 1899.

Hornaday (1913) reported that desert bighorn sheep in the Lago de Santa Maria area had become "recently exterminated," presumably about 1910. In 1921, Charles Sheldon inquired about the status of this population from an experienced local hunter (Pedro Zorrilla) who had accompanied him on earlier desert bighorn sheep hunts in the area (Sheldon 1925:178). Zorrilla reported that bighorns were probably extirpated then in the Lago de Santa Maria area. Leopold (1959) showed this area to be part of the "present" range of bighorn sheep in Mexico in the 1950s. Villa (1959) received no reports of desert bighorn sheep here in 1957–1958, but we (EMM) confirmed the presence of desert bighorn sheep in Rincon de Chihuahua in the early 1960s. The lack of formal surveys and terrain ruggedness probably accounts for Zorrilla's assumption that they had been extirpated. However, desert bighorn sheep probably did not persist much later than the mid-1960s because we were not able to locate reports of them in this area after that date.

(3) *Banco de Lucero, Sierra San Miguel, El Chilicote, and Sierra Grande.*— Charles Townsend (1903) also hunted the mountains north of El Carrizal and collected 3 specimens of desert bighorn sheep (adult male, adult female, and young male) on 25 April 1902. These were sent to the Chicago Academy of Sciences where Frank Woodruff made life-like dioramas of these desert bighorn sheep and other southwestern wildlife (Hendrickson and Beecher 1972). The display of 3 desert bighorn sheep collected by Townsend was later transferred to the Notebaert Nature Museum in Chicago with accession numbers 88, 89, and 90 (Figure 4).



Figure 4. Desert bighorn sheep collected by Townsend (1903) in mountains north of El Carrizal in northwestern Chihuahua (Photo courtesy of Chicago Academy of Sciences).

Townsend (1903) apparently returned to these mountains because on 8 October 1902 he collected a male and female that were sent to the Smithsonian Institution (USNM 115687 and 115688).

Charles Sheldon (1925:173) reported that during the time he lived in Mexico (1898–1902) 40–50 desert bighorn sheep still occupied "a small group of mountains about 20 miles west of Villa Ahumada, including Banco de Lucero, Chilicote and

Sierra Grande, all joined together by ridges." He also believed this population of desert bighorn sheep did not interchange with those that occupied the area around Lago de Santa Maria (Sheldon 1925:173). Don Manuel Manterola Dio hunted with Charles Sheldon's old guide, Pedro Zorrilla, in 1909 and harvested the only 3 desert bighorn sheep they saw (2 rams and 1 ewe) in El Chilicote (Imaz-Baume 1949). Since 2 rams and a ewe was all that was seen in this mountain range the previous year, it was thought that these were the last remaining desert bighorn sheep. When Sheldon (1925) inquired about this population in 1921, Pedro Zorrilla told him they were extirpated.

(4) *Candelaria Mountains*.—This small and isolated mountain range is not mentioned in historical accounts, but the prior presence of desert bighorn sheep is suggested by the desert bighorn sheep rock art left there by much earlier inhabitants. These mountains lie about 40 km north of Banco de Lucero and 120 km south of El Paso, TX. The Candelaria Mountains contain 1 natural spring that was well known to early inhabitants and obviously served as a frequently occupied site. This area, and the nearby Sierra la Ranchería, contain some of the most remarkable petroglyphs from the Archaic Period (7,500 to 2,000 years ago). Petroglyphs in this area are so unique they are referred to as "The Candelaria Style" (Davis 1979:53, cited in Mendiola-Galván 1998).

Schaafsma (1980:57) illustrates a reconstruction of some of the Candelaria Mountain petroglyphs and rock art containing desert bighorn sheep. The rock art consists of square-bodied rams painted in light red amid a motif of hunting activity. The rams depicted are shown in a frontal view, which is uncommon in rock art in the Southwest (Schaafsma 1980, but see Murray and Espinosa 2006). The desert bighorn sheep on these panels appear to have been

added later than the original Archaic artwork; just how much later is unknown, but there is a similar addition of men with bows that indicates it was within the last 1,000 years. The primary theme of the underlying artwork is that of hunters killing big game so the addition of the bighorn sheep rock art at a later date is a strong indication that desert bighorn sheep were important quarry to local inhabitants. The presence of shaman-like figures indicates there is not only utilitarian, but perhaps some religious significance to the petroglyphs as well.

Mendiola-Galván (1998:20) reproduced an illustration derived from Davis (1979:53), showing desert bighorn sheep rock art from the Candelaria Mountains and the Sierra la Ranchería. The rock art depicts what appears to be male and female desert bighorn sheep in red paint among human hunters wielding spears.

(5) *Sierra las Escaramuzas and Sierra El Rayo*.—Leopold (1959:525) listed this range as former habitat, but no longer occupied. However, in a book of his hunting exploits, Victor López-Gardea (1974) details his 1942 desert bighorn sheep hunt in the Sierra las Escaramuzas. He killed a ram that year in a saddle called La Vibora situated between the Sierra El Rayo and Sierra las Escaramuzas and it was given as a gift to the President of Mexico, General Manuel Avila Camacho (Figure 5, López-Gardea 1974:110). Gustavo "Michy" Schneider in the city of Chihuahua owns a mounted desert bighorn sheep head that was killed by taxidermist and well-known hunting guide, Alejandro López Escalera in Sierra las Escaramuzas in 1946 (Figure 6).



Figure 5. Victor López Gardea poses with the ram he killed in Las Escaramuzas in 1942 and presented as a gift to the president of Mexico.



Figure 6. Alejandro López Escalera killed this ram in Sierra las Escaramuzas in 1946.

(6) *Sierra el Jabali*.—A colored photograph from 5 February 1937 shows a pair of happy hunters and one tired horse

after a hunt in El Jabali Mountains (Figure 7). The hunters are Lieutenant Colonel Romero Gallardo of the Mexican Army and local guide-taxidermist Alejandro López Escalera with 2 young rams and a desert mule deer.

A desert bighorn sheep ram skull mounted on a plaque in the city of Chihuahua is said to have been killed in the Sierra el Jabali on a later hunting trip by Alejandro López Escalera in 1944. This was possibly 1 of the last desert bighorn sheep in that mountain range; Leopold (1959:525) listed this range as former desert bighorn sheep habitat no longer occupied in the late 1950s.



Figure 7. Lieutenant Colonel Romero Gallardo of the Mexican Army and local guide-taxidermist Alejandro López Escalera with 2 young rams and a desert mule deer taken in the El Jabali Mountains in 5 February 1937.

(7) *Sierra el Morrion*.—This mountain range was well known as a historical population of desert bighorn sheep. Sheldon (1925:172) mentions that he "used to admire three or four fine skulls hanging on the walls of a house of an aged ranch owner then living. These sheep had been killed by his vaqueros sometime before 1860, on mountains twenty miles north of Chihuahua [City]." These mountains are the Sierra el Morrion and desert bighorn sheep persisted there up to at least 1940, but were extirpated by the time Leopold wrote his book *Wildlife of Mexico* in the late 1950s.

(8) *Sierra los Hechiceros*.—Baker (1956:328) reported that Juan José Zapata of the Hacienda Rincón knew of a band of desert bighorns living in these mountains in 1953. Desert bighorn sheep in the Sierra los Hechiceros may have persisted into the 1960s (Anderson 1972:394, Leopold 1959), but Villa (1959) failed to find any during a field reconnaissance in 1957–1958 despite credible local reports.

(9.) *Sierra San Francisco (including El Cimarron to the north)*.—El Cimarron is a small, isolated peak to the north of Sierra San Francisco and was probably occupied by desert bighorn sheep periodically. There are few records associated with desert bighorn sheep in this mountain range, but it is close to Sierra del Diablo (see below) for which there are consistent records of desert bighorn sheep. We [EMM] confirmed the presence of desert bighorn sheep in this mountain range during field reconnaissance in 1963.

(10.) *Sierra del Diablo*.—There were reports of a “sizable band of sheep” on the Rancho La Ventura near this mountain range (possibly in the neighboring Sierra el Almagre) as late as the mid-1950s (Baker 1956:329). Anderson (1972:394) mentions field notes of a 1954 conversation with a hotel owner in Jimenez, Chihuahua who reported that desert bighorn sheep were seen in recent years in the Sierra del Diablo. Although Villa (1959) did not locate any desert bighorn sheep during his field trip in 1959, they occurred in this mountain range at the time because we [EMM, personal observation] observed them during field reconnaissance in the early 1960s. In 1960, a group of desert bighorn sheep were discovered by cowboys in that mountain range while moving cattle to a new watering site. The desert bighorn sheep were quickly pursued and a ram was shot (Figure 8). Trefethan (1975:141) states that there was “for sure” a small herd of about 50 desert

bighorn sheep still inhabiting the Sierra del Diablos in the 1970s, but does not mention his sources.



Figure 8. A ram harvested in Sierra del Diablo in 1960 by a hunter in Saltillo, Coahuila. (Photo courtesy of Alejandro Espinosa).

(11.) *Sierra Mojada*.—Sierra Mojada is about 40 km east of Sierra del Diablo and straddles the Chihuahua-Coahuila border. This mountain range was noted as having desert bighorn sheep in the late 1950s by Villa (1959), Leopold (1959:525) and Baker (1956:329). Most of this population was in the state of Coahuila and apparently the last mountain range to hold a remnant population in either Coahuila or Chihuahua, with desert bighorn sheep persisting until about 1970 (Espinosa et al. 2006).

Discussion

The conservation of desert bighorn sheep in Mexico is hampered by the lack of protection and the frequent shifting of responsible management agencies, responsibilities, and reorganization of departments (Valdez et al. 2006). Depending on the direction of past Mexican

presidents, wildlife has been administered by several different agencies over the last few decades (Tarango and Krausman 1997). Those responsible for Mexican wildlife conservation are frequently placed in a small, under-funded department within a larger agency, whose responsibilities may be very different from conservation issues (e.g., urban development, agriculture, livestock, social development).

Although there is a firm legal basis for wildlife administration in Mexico, the governmental infrastructure has lacked historical stability, continuity, and funding. In addition, there continues to be no effective state or federal wildlife law enforcement in Mexico, rendering the wildlife laws ineffective. There are many people concerned about the future of wildlife conservation in Mexico and would like to see the establishment of an effective, well-funded, and perpetual administrative system, but such changes are restrained by deep ties to economic and social issues.

Desert bighorn sheep are an important part of Chihuahua's natural heritage. In addition, properly managed desert bighorn sheep populations can make an important economic contribution to the state's economy. Interest in hunting desert bighorn sheep remains strong, which provides an incentive to manage these animals as a renewable natural resource.

The state of Chihuahua is beginning to establish a recovery program. The first step of any successful desert bighorn sheep restoration is to identify historical occurrences. The next step will be to evaluate these historical ranges and any others that appear suitable for desert bighorn sheep occupation using any of the established bighorn habitat evaluation procedures (Brown 1983, Wakeling and Miller 1990, Cunningham 1993). This has begun in the State of Chihuahua. The evaluated ranges will then be prioritized by

habitat quality so translocations can occur in priority to maximize the success of restoration efforts.

The future success of desert bighorn sheep restoration in Chihuahua will hinge on the ability of those involved to avoid placing limited desert bighorn sheep in less suitable habitat for socio-political reasons. Translocation priority must be based solely on biological factors. It is preferable that bighorn sheep used for restoration be wild-caught and released without being held in captivity. If sufficient source stock are not available, very large enclosures might be a viable option for providing the necessary animals. This is currently being attempted with a 3,000 ha enclosure on La Guarida Ranch. Regardless, restoration efforts should be based on a model of wildlife and habitat management, rather than animal husbandry. This is the protocol now being used successfully by Arizona, New Mexico, and other U.S. states. The future of desert bighorn sheep in Chihuahua lies in wild animals released in the best habitat with adequate protection.

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James R. Heffelfinger... Enrique Marquez-Muñoz...