

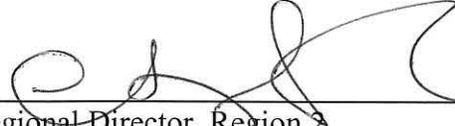
**Supplemental Finding for *New Mexico Ridgenose Rattlesnake Recovery Plan***

**Original Approved:** March 22, 1985 (signed date)

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**For  
U.S. Fish and Wildlife Service  
Southwest Region 2  
Albuquerque, NM State**

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Regional Director, Region 2  
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**BACKGROUND INFORMATION**

Section 4(f)(1)(B)(ii) of the Endangered Species Act (Act) requires that each recovery plan shall incorporate, to the maximum extent practicable, “objective, measurable criteria which, when met, would result in a determination...that the species be removed from the list.” It is possible that for some species, however, delisting cannot be foreseen at the time a recovery plan is written. In some rare cases, the best available information is so seriously limited that it is truly not possible to identify delisting criteria. This would be an unusual case, such as one in which the species’ threats are not understood well enough to identify priorities and appropriate actions to remove (or offset) the threats. For example, the natural habitat may have been so reduced for an endangered species that captive propagation and active management is necessary for the life of a reasonable recovery plan. In another example, the population of a long-lived, slow growing species may be so depleted that possible recovery may be beyond the life of a reasonable recovery plan.

A 2006 Government Accountability Office (GAO) audit of the National Marine Fisheries Service’s (NMFS) and Fish and Wildlife Service’s (USFWS) endangered species recovery programs recommended that the Secretaries of the Department of Commerce and the Interior direct their staff to ensure that all new and revised recovery plans have either recovery criteria evidencing consideration of all five delisting factors or a statement regarding why it is impracticable to do so (GAO 2006). Since the 2006 GAO audit, we have updated our recovery planning and implementation guidance (NMFS and USFWS 2010), and new plans have included determinations regarding the feasibility or possibility of incorporating delisting criteria related to each of the five factors, as recommended by the GAO. Active recovery plans remain, however, that lack delisting criteria and contain either an incomplete determination regarding the practicability of incorporating delisting criteria, or are silent about the absence of delisting

criteria in the recovery plan. In this document, we clarify why it remains impracticable to incorporate delisting criteria for the New Mexico ridge-nosed rattlesnake (*Crotalus willardi obscurus*) in the 1985 New Mexico Ridgese Rattlesnake Recovery Plan (Recovery Plan).

## **METHODOLOGY USED TO COMPLETE THE FINDING**

This supplemental finding was conducted by New Mexico Ecological Service Field Office (NMESFO) staff using information from the 1985 Recovery Plan, peer-reviewed articles, agency reports, and other documents available in the NMESFO files. The NMESFO did not explicitly seek input from New Mexico Department of Game and Fish (NMDGF) and Arizona Fish and Game Department (AFGD) regarding this finding; however, the NMESFO made a request to both state agencies for information pertinent to this finding. We continue to coordinate with both state agencies while we conduct a 5-year review that is currently under analysis at the time of this supplemental finding. The information presented here primarily comes from peer-reviewed published literature, agency reports, and graduate thesis or dissertations. These sources of information do not report specific data regarding locality or population estimates. The NMESFO is continuing its efforts to work with NMDGF, AFGD, and researchers that have worked with this subspecies to obtain data that are located in disparate locations, mostly in hand-written format in field books and notes of multiple individuals.

## **FINDING**

The New Mexico ridge-nosed rattlesnake was listed as threatened in 1978 and its Recovery Plan finalized in 1985. The New Mexico ridge-nosed rattlesnake is one of five recognized subspecies of ridge-nosed rattlesnakes (*Crotalus willardi*) belonging to the viper family (Viperidae). There are 3 isolated populations of the New Mexico ridge-nosed rattlesnake subspecies. Figure 1 represents an older general distribution for all subspecies *Crotalus willardi* excerpted from Barker 1992 (p. 90), with the 3 populations that comprise the range of the New Mexico ridge-nosed rattlesnake in polygons 1, 2, and 3. The New Mexico ridge-nosed rattlesnake occurs in the Peloncillo Mountains of southwestern New Mexico and southeastern Arizona, the Animas Mountains in the southwestern corner of New Mexico, and the Sierra San Luis Mountains in northern Mexico. Figure 2 (excerpted from Holycross and Douglas 2007, p. 144) represents projected habitat type and the areas sampled for an assessment of connectivity among the three populations of the New Mexico ridge-nosed rattlesnake. We present these maps because we do not presently have specific locality data for the subspecies at this time to create distribution maps. The maps presented in this finding represent the best available information regarding the distribution of the subspecies at this time. The subspecies was listed primarily due to its narrowly restricted range, coupled with over collection and habitat modification. When the Recovery Plan for the New Mexico ridge-nosed rattlesnake was completed in 1985, little was known about the natural history of the subspecies, and detection of the subspecies in the Peloncillo Mountains in New Mexico and Arizona had not yet occurred.

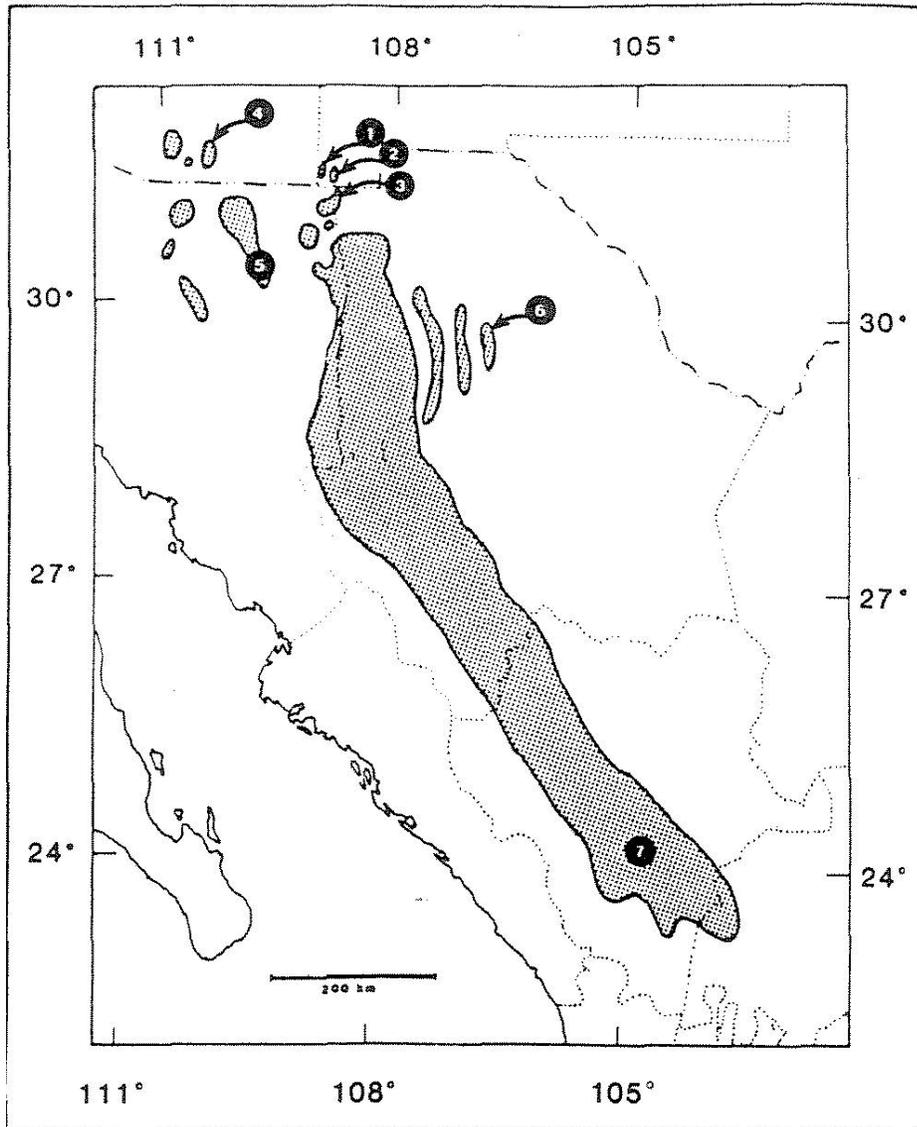


Figure 1. The distribution of *Crotalus willardi* populations sampled to assess intraspecific relationships and biogeography of the ridge-nosed rattlesnakes (excerpted from Barker 1992, p. 90). The New Mexico ridge-nosed rattlesnake is represented by the Peloncillo Mountains, NM (1); the Animas Mountains, NM (2); and the Sierra San Luis, Sonora, Mexico (3). Subsequent to this publication (Barker 1992), the subspecies has also been observed in Arizona just over the New Mexico-Arizona border in the Peloncillo Mountains (1).

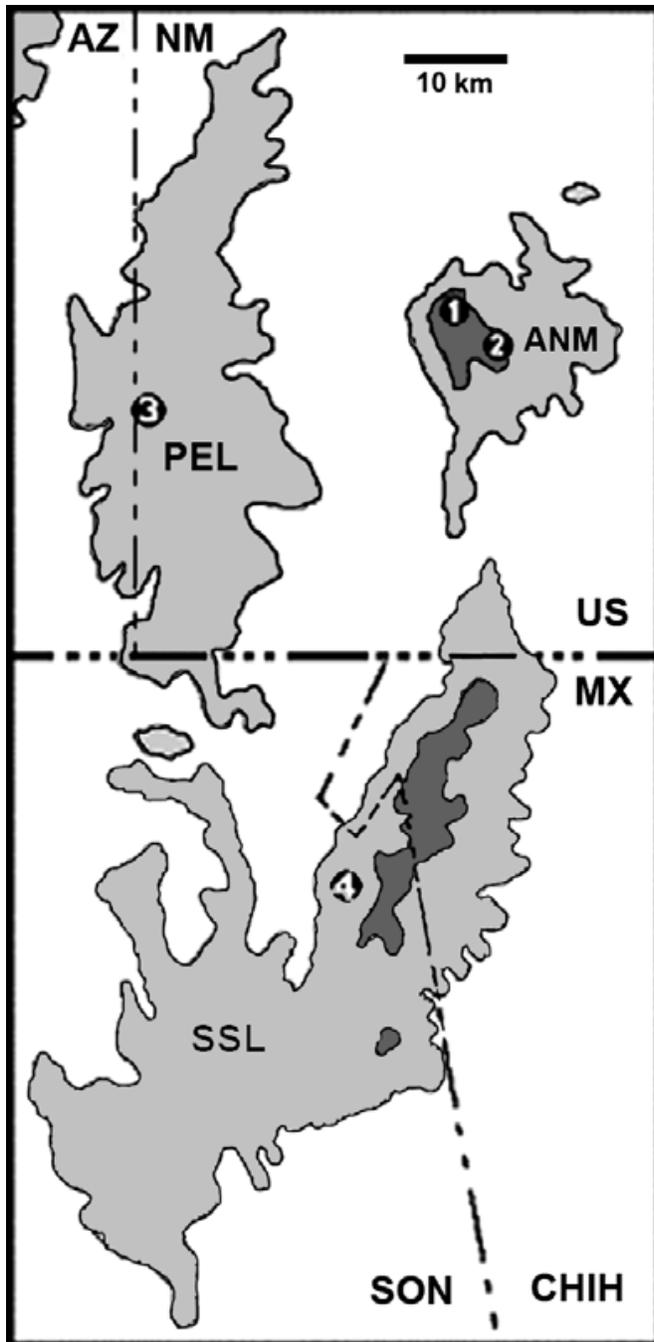


Figure 2. Habitat types and sampling locations of *Crotalus willardi obscurus* populations as presented in Holycross and Douglas 2007 (excerpted from Holycross and Douglas 2007, p. 144). The numbers represent sampling locations used to assess genetic connectivity among populations. The New Mexico ridge-nosed rattlesnake is represented by three populations: the Animas Mountains, NM (represented by two sample sites: 1. West Fork Canyon and 2. Indian Creek Canyon; ANM); the Peloncillo Mountains, NM and AZ (PEL); and the Sierra San Luis, Sonora and Chihuahua, Mexico (SSL). The light gray polygons delineate Madrean Evergreen Woodland vegetation type and the dark gray represents Petran Montane Conifer forest as reported in Brown 1994 (excerpted from Holycross and Douglas 2007, p. 144).

The 1985 Recovery Plan does not have recovery criteria. However, a summary paragraph in the Recovery Plan states that the very restricted range may preclude delisting, but that reclassification to non-threatened status (i.e, delisting) could be considered when 3 non-specific targets have been met. This summary statement is presented below, as it appears in the Recovery Plan.

#### SUMMARY

Even though the very restricted range of *Crotalus willardi obscurus* as it is presently known may preclude eventual delisting, reclassification to non-threatened status, nonetheless, could be considered when:

- 1) All important areas of *C. w. obscurus* habitat in Mexico and New Mexico are identified;
- 2) *C. W. obscurus* habitat in New Mexico is protected from adverse modification; and
- 3) The continued existence of the taxon in its habitat is assured.

Steps to reach recovery include identification and protection of important habitat and gaining additional information, through research, concerning unknown aspects of the taxon's life history.

To keep the subspecies recovered, it will be necessary to provide adequate protection and management of important habitat. This must include entering into land management agreements with private landowners and monitoring *C. w. obscurus* populations to assure continued survival of viable populations.

A 5-year review for the New Mexico ridge-nosed rattlesnake was initiated May 31, 2018 (83 FR 25035), and is currently underway. We have reviewed relevant literature and reports pertaining to the subspecies. Since the Recovery Plan for the subspecies was completed, multiple studies concerning the natural history of the subspecies in the Animas Mountains have been conducted. While this information is helpful in understanding the needs of the subspecies in this mountain range, it is limited because the ecological setting, habitat use, and occupancy are very different in the different populations of the subspecies. Holycross and Douglas (2007, p. 151) report that the three populations of the New Mexico ridge-nosed rattlesnake are discrete and lack connectivity, but also that they are estimated to have differing population parameters (the Sierra San Luis population is large in size; the Animas is smaller; and the Peloncillo Mountains population is minuscule in size) and vary in habitat use by elevation (between 1900–2590 meters in the Sierra San Luis; above 2100 meters in the Animas Mountains; and between 830–1520 meters in the Peloncillo Mountains), which in turn influences diet in the different populations and can result in differential impacts from different threats. Information on exact population sizes or specific habitat use at different elevations was not provided.

The threats affecting the subspecies, and the magnitude and immediacy in which they are affecting each population, vary by population; some of which we either lack information or the ability to measure to determine the magnitude and immediacy. Outside of the estimates and

conclusions provided in Holycross and Douglas (2007 entire), we have no updated information regarding the status, occurrence, or threats of the subspecies in the Sierra San Luis Mountains, Mexico, since the subspecies was listed in 1978.

The threats currently affecting the subspecies include those that were present at the time of listing (collection; habitat alteration) as well as additional threats not addressed at the time of listing (lack of connectivity among populations; small population sizes; hybridization; changing climate). Additionally, the habitat alteration impacts are different now than at the time of listing. At the time of listing, invasive (blasting) and destructive (tearing up rock cover) techniques were used to collect the subspecies, and added to the threat of over-collection. Since listing, this type of habitat alteration is no longer a significant concern; however, habitat alteration and loss is a threat affecting the subspecies. Current habitat alteration and loss primarily stems from forest type conversions resulting from forest management practices over the last century (including fire suppression) that have caused shifts in the natural fire regime resulting in large-scale, unplanned forest fires or unnatural prescribed fire regimes, and ultimately vegetation type conversion from suitable woodland habitat to unsuitable chaparral and grassland habitat (Holycross and Smith 2001, p. 1).

Fire-related habitat changes and impacts coupled with climate change and future climate change projections result in continued declines and loss of available habitat. While we are not aware of any information that documents habitat use by the subspecies pre- and post-fire to determine actual impacts from changes in fire regimes or changes in habitat features, Davis et al. (2015, entire) used long-term mark-recapture data and molecular data from the Animas Mountains to model impacts of climate change while considering the geographic restrictions (occurrence on “sky-islands” of the southwest) and impacts from wildfire. Davis et al. (2015, entire) concluded that while survival of the subspecies is significantly influenced by wildfire at upper elevations within its habitat, the subspecies is experiencing an “extinction vortex” that is overall being driven by small population dynamics. An extinction vortex is a process in small populations whereby it continues its trajectory towards extinction and is a result of mutually reinforced factors that collectively contribute to the deterioration of that population (Fagan and Holmes 2006, pp. 58–59). Davis et al. (2015, p. 2) further raise concern that the conservation issue at hand rises above that for the subspecies-specific concern of the New Mexico ridge-nosed rattlesnake and extends to concern over the trajectory of the collapse of the Madrean Pine-Oak ecosystem to which the subspecies is restricted. Davis et al. (2015, p. 15) suggest that the New Mexico ridge-nosed rattlesnake is rapidly moving towards extinction, that some efforts could be put in place to slow the rate, but will not likely prevent extinction unless ecosystem-level conservation strategies and initiatives are developed and implemented. The published literature only summarizes the long-term mark-recapture data. We do not possess any population level data and are not able to develop population-level criteria, nor are we currently able to design ecosystem-level conservation strategies to mitigate for climate change and wildfire in New Mexico ridge-nose rattlesnake sky-island habitat, and abating the threat of habitat loss will take novel and yet to be developed strategies.

Wildfire and prescribed fire not only have the potential to directly affect habitat features important to the subspecies, but can also affect its prey. We are aware of a study that was conducted in the Animas Mountains assessing the potential impacts to New Mexico ridge-nosed

rattlesnake prey resulting from wildfire, but are not aware of any reports or publications that report the findings. Thus, potential impacts to prey from changes in fire regimes remains unknown at this time.

Illegal collection of the subspecies likely occurs because of its unique coloration, scale structure, and rarity; all features that can be highly desired by collectors. Specimens would likely have a high value on the black market. For example, another subspecies from Mexico (*Crotalus willardi silus*) was recently available for purchase on the open market and advertised on the internet for \$1500 (Kingsnake.com classified ad dated July 19, 2018). The less available and more difficult a species is to collect, the greater the monetary value, and thus the value of New Mexico ridge-nosed rattlesnakes likely greatly exceeds the value of other subspecies. In a 1996 newspaper article (Phoenix New Times), it was reported that their value on the black market can be \$5,000 or more. It is not feasible to measure or monitor the threat of illegal collection for the subspecies, and impacts to populations are not known. Furthermore, the range of the subspecies occurs in very remote areas, and increasing the presence of law enforcement to abate the threat in the United States or Mexico is not likely to be achieved.

Disease and parasites were listed as a potential concern in the Recovery Plan, but we are not aware of any new information to know whether disease or parasites affect the subspecies. Additional threats that were not addressed at the time of listing or in the Recovery Plan include lack of connectivity among populations, small population sizes in the Peloncillo and Animas Mountains populations, hybridization in the Peloncillo Mountains resulting from extremely low numbers (Campbell et al. 1989, entire; Holycross and Douglas 2007, p. 150), and climate change impacts for a high-elevation, montane subspecies, as discussed above as it relates to habitat alterations and loss.

In summary, it remains not practicable to develop delisting objectives and criteria at this time for the following reasons:

1. Some of the major threats affecting the subspecies now and in the foreseeable future cannot be measured, monitored, or abated (illegal collection, continuous habitat alteration and loss);
2. We lack the necessary information regarding impacts to the subspecies for some potential threats (prey availability, hybridization, disease); and
3. We lack population-level information and cannot develop population-level criteria.

The threats that cannot be measured, monitored, or abated include illegal collection and continuous habitat alteration and loss due to climate change and altered fire regimes. We currently lack data as it pertains to some threats such as prey availability, hybridization, disease, population connectivity, and small population size and related genetic impacts. We are aware that data have been collected that could help inform our understanding of some threats. There is a high need to obtain, compile, and analyze these existing data that are currently held by a variety of researchers and volunteers. We will continue working with NMDGF, AFGD, and subspecies experts to obtain existing data related to populations and threats to the subspecies.

Some threats, such as small population size or impacts from prescribed fire could potentially be abated, and we recommend that in these cases, conservation actions should be developed and included in a future update to the Recovery Plan.

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