

# Proposal to Up-list Narrow-headed Gartersnake from State-Threatened to State-Endangered

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Photograph by C. Painter, NMDGF

**Prepared by  
Leland J. S. Pierce  
Wildlife Management Division  
New Mexico Department of Game and Fish  
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## Executive Summary

Narrow-headed Gartersnake, *Thamnophis rufipunctatus*, is currently listed as threatened by the State of New Mexico and threatened under the federal Endangered Species Act. The species is a habitat specialist, occurring only in shallow, swift-flowing, rocky rivers and streams of the San Francisco and Gila River drainages, and the species feeds almost exclusively on fish. Detection probability is low but experts can find the species with sufficient trapping via minnow traps. Captive rearing is extremely difficult. In the 1990s the species was known from over 40 localities with 3 robust populations. As of this proposal the species has been found in only 7 of 17 historical sites that were the focus of survey efforts over last three years and only one robust population remains. Other populations are very low in numbers and all populations have very low genetic diversity. Post-fire flooding likely led to the extirpation of the most important sites in New Mexico and, where found, the species is associated with native-fish. Along with spiny-rayed non-native fish like bass and catfish, other concerns are non-native bullfrogs and crayfish and potentially disease. These factors indicate the species is of sufficient concern to warrant uplisting to endangered by the State of New Mexico.

## **Status**

Common name: Narrow-headed Gartersnake

Species name: *Thamnophis rufipunctatus*

State-listed: Threatened

Federally-listed: Threatened

Species of Greatest Conservation Need, Federally-listed Category

The species is listed by the US Fish and Wildlife Service (USFWS) for federal protection as threatened under the U.S. Endangered Species Act (USFWS 2014). Currently USFWS has initiated the development of a "Species Status Assessment" document, which is the first step toward the development of Federal Recovery Plan for the snake (J. Servoss, USFWS, *pers. comm.*). The recovery plan is proposed to be completed within 2-3 years. In addition, critical habitat has been proposed (USFWS 2020).

## **Natural History**

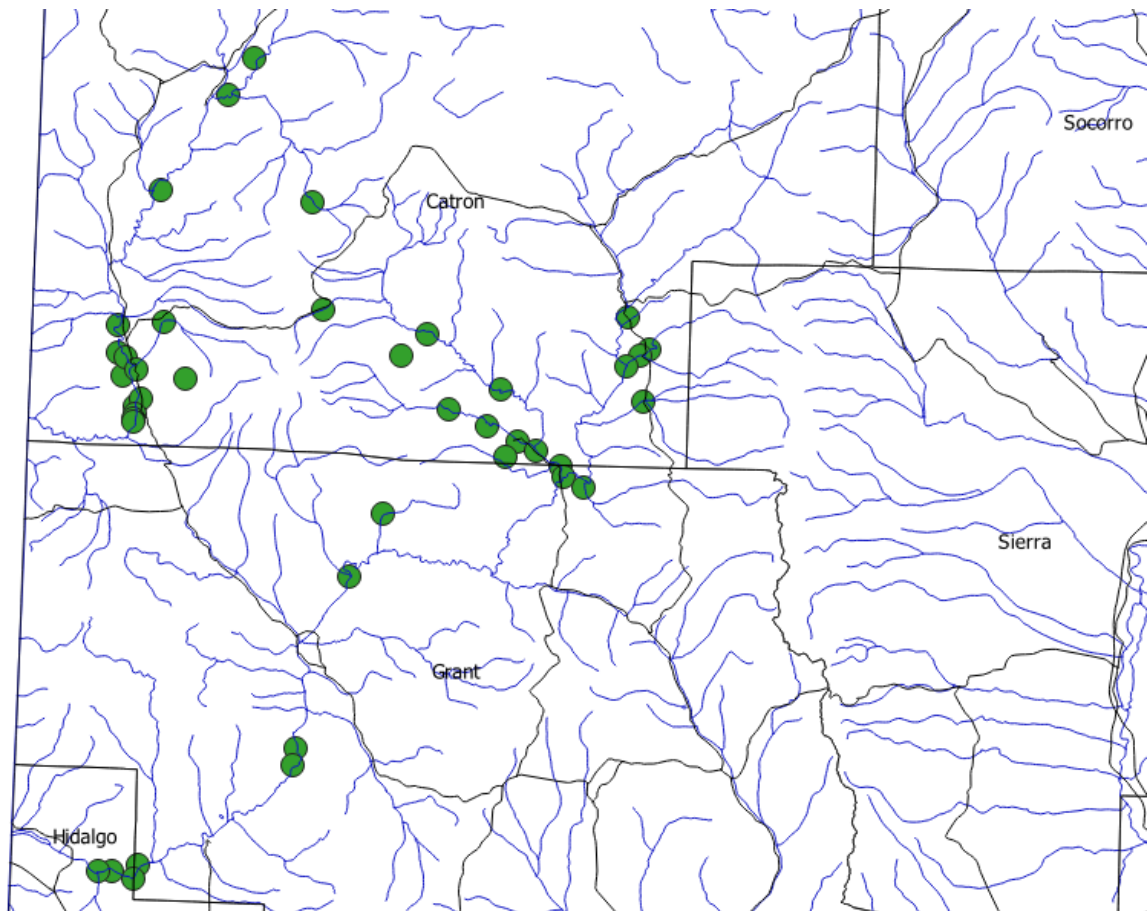
Narrow-headed Gartersnake ranges from north-central Arizona to southwestern New Mexico, and from northern Chihuahua to northern Durango, Mexico (Rossman et al. 1996). In New Mexico, the species is confined to Catron, Grant, and Hidalgo counties where it reaches the northern and eastern edge of its overall distribution (Degenhardt et al. 1996). Narrow-headed gartersnakes are aquatic specialists that feed almost exclusively on fish, using specific habitats for foraging (clear, rock-boulder strewn streams) and adaptations to give the species increased underwater visual and foraging capabilities (eyes on the top of the head, the head narrowed to allow the snake to face into a swift flowing stream; Fleharty 1967, Schaeffel and de Queiroz 1990, Alfaro 2002, Hibbitts and Fitzgerald 2005). The species most commonly hunts from rocks within the stream, striking out at passing fish. The snakes can also be found under rocks near the stream and basking on branches overhanging the stream; the snake will drop into the water and flee when disturbed. The species is live-bearing. Narrow-headed gartersnakes are non-venomous but will inflict a painful bite if handled. Detection probability is low for this species but experts can find the species with enough trapping via minnow traps along with visual encounter surveys (Christman et al. 2015, Jennings et al. 2017, 2018, 2020).

Captive rearing is poorly understood as the species appears to be very delicate outside of its native habitat and is quite vulnerable to disease while in a captive situation. As the species requires flowing water as part of its life history, the logistical requirements for maintaining a healthy captive population, much less to have a population that is willing to reproduce, requires extensive expertise and expense. Given the delicacy of the species, several efforts at keeping the species in captivity have failed, such as at the Albuquerque BioPark due to various diseases and infestations of mites. Snakes are currently kept at Northern Arizona University but have had several deaths due to disease. The only successful population is housed at the Phoenix Zoo. This population is intensively managed with extensive resources dedicated to sustaining the snakes. This may not be feasible in other locations

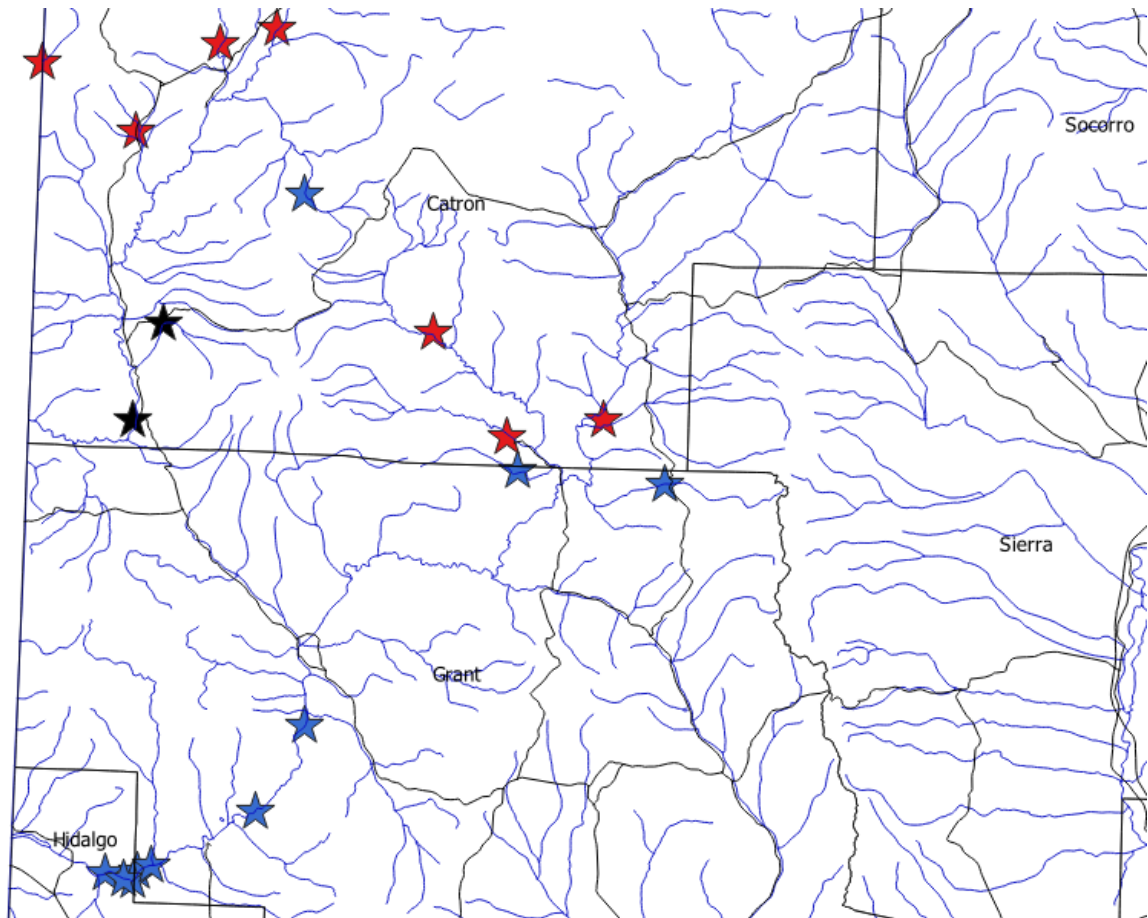
## **Conservation Concerns**

By the 1990s the species was known from over forty localities, based upon museum records, observations and communications with USFS biologists, with three robust populations (Jennings et al.

2018; See Figure 1). From 2017 to present researchers under contract with the Department have been surveying historic sites to determine current status (Jennings et al. 2020), focusing on sites that are most likely to have viable populations of the gartersnake. As of 2019 the species is only known from 7 confirmed locations, with only one population considered robust (Hibbitts et al. 2009, Jennings et al. 2020; See Figure 2). All other populations are small and therefore vulnerable to extirpation through disturbance like fire and flooding (Figure 3). Two of the most robust populations from the 1990s, one at San Francisco Hot Springs was potentially the most robust population in the United States, and the other population at Whitewater Creek, are now extirpated from the aftereffects of catastrophic wildfires (Hibbitts et al. 2009, Christman et al. 2015).



**Figure 1.** Map of known historical localities. Localities are based upon observations by biologists, historical records and museum specimens (Jennings et al. 2017).



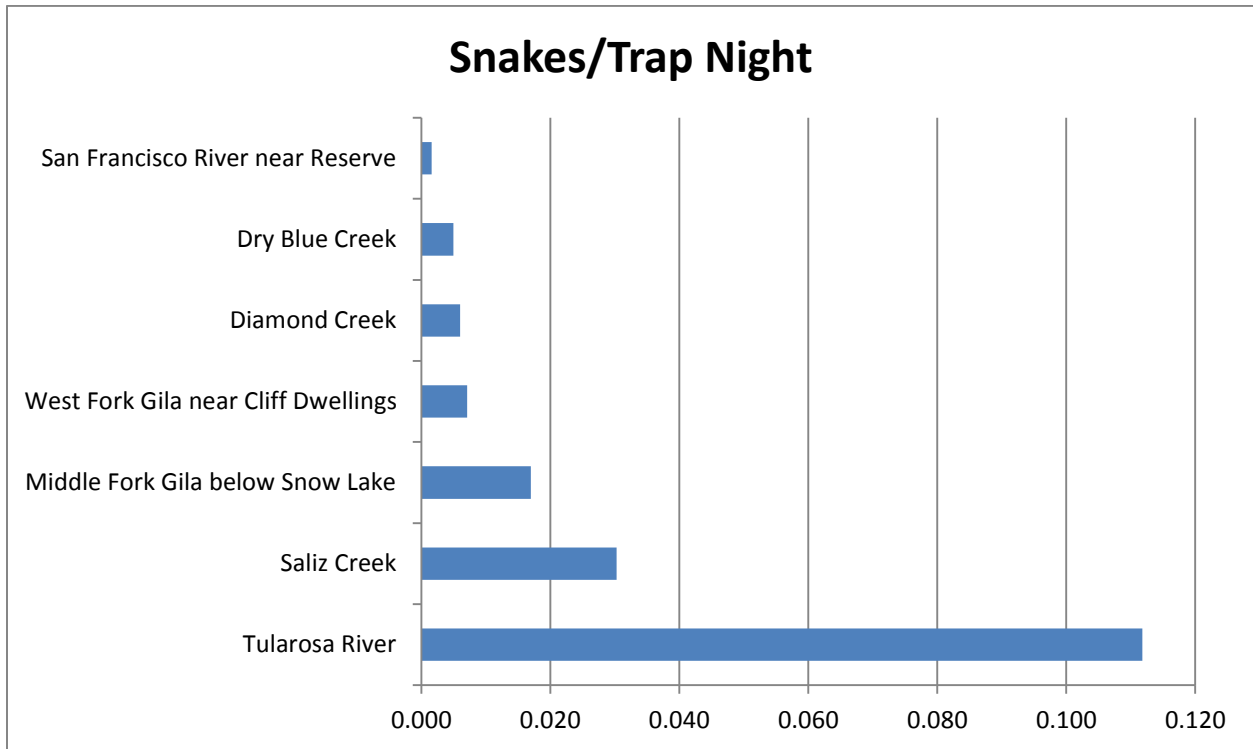
**Figure 2.** Historic sites surveyed for Narrow-headed gartersnake 2017-2019. Red Stars are survey sites where the snakes are still present, Blue Stars are survey sites where no snakes were detected (see Jennings et al. 2020). The two most robust historical populations, marked with a Black Star, San Francisco Hot Springs and Whitewater Creek, are now extirpated (see discussion below).

Specific concerns are as follows:

### **Low Adaptive Capacity**

Known populations have low numbers and low genetic diversity, indicating that current Narrow-headed gartersnake populations have a reduced capacity to adapt to changing conditions and disturbances. Therefore, translocation work may be needed not only to supplement populations but also to inject genetic diversity. Of the currently known populations, only the Tularosa River population in Catron County, is considered robust (See Figure 3). By comparison, the most robust population from the 1990s, near San Francisco Hot Springs, now extirpated due to the aftereffects of catastrophic wildfire, had over twice the density of snakes than currently found at the Tularosa River site. In addition, research indicates the species has very low genetic diversity and low dispersal (Wood et al. 2011, 2018). Even as populations might be rediscovered (such as Blue Creek in 2018 and along the San Francisco River in 2019), given the overall patterns of low numbers and genetic isolation of the species, those populations

are very likely to be below necessary adaptive potential for those populations to survive long-term without active management such as translocation and genetic mixing. Long-term recovery of the species will be dependent upon having multiple robust populations across the range that are resilient toward disturbance such as wildfires and post-fire floods.



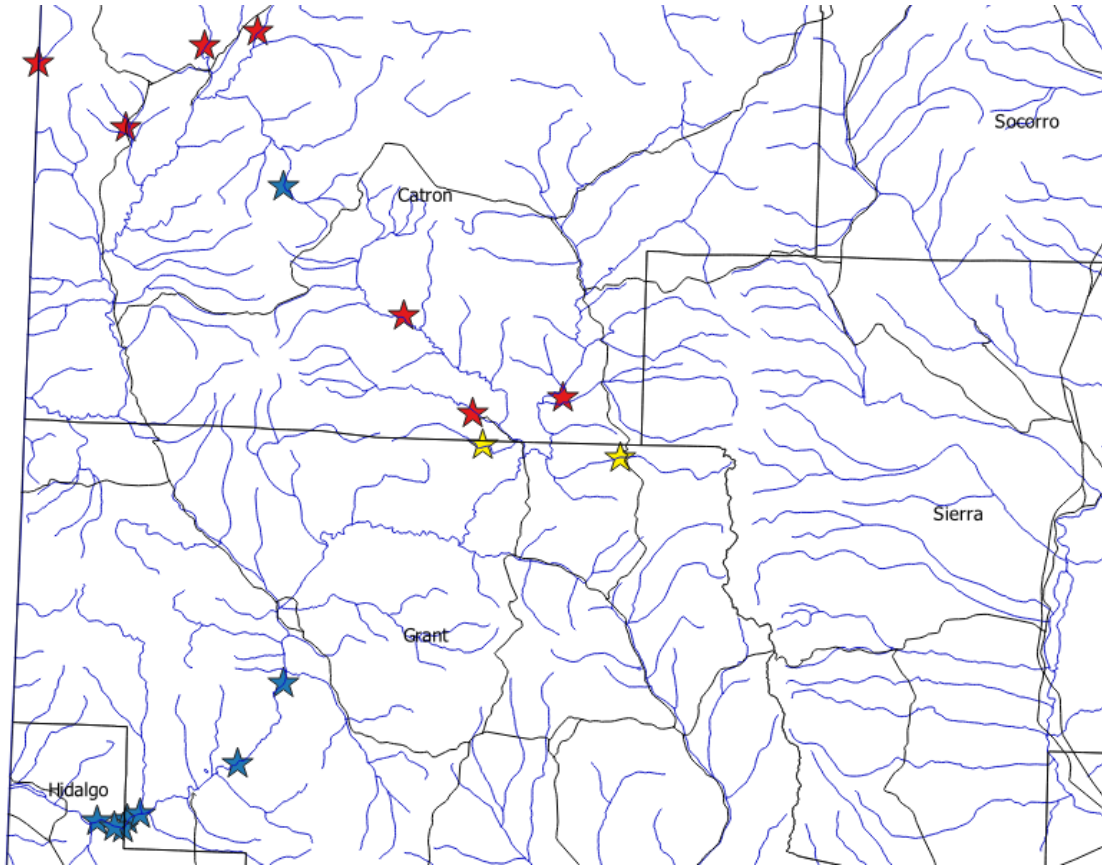
**Figure 3.** Number of snakes caught via Gee minnow traps per trap night during surveys from 2017 – 2019 (Jennings et al. (2017, 2018, 2020).

### Post-fire flooding

Following fires, particularly large-scale wildfires, flooding can have devastating effects on populations of Narrow-headed gartersnakes, through loss of habitat, prey base, or both. The most robust population in the state of New Mexico, found near San Francisco Hot Springs, was extirpated most likely due to siltation from post-fire flooding as the silt filled in the crevices the gartersnake requires for foraging (Hibbitts et al. 2009). The second most robust known population, found at Whitewater Creek, was likely extirpated by post-fire floods decimating the fish populations in the system, the snake's prey base, following the 2012 Whitewater-Baldy Fire (Christman et al. 2015). Snakes were found in 2014 in very poor conditions, emaciated, and no snakes were found at Whitewater Creek in 2015. Prevention of catastrophic, large-scale wildfires that extirpate the fish prey base of the gartersnake along with having multiple robust populations will be important factors toward the recovery of this species.

### Native Fish Requirement

From 2017-2019 the species was detected only in association with native fish communities. The precise reasons for this are unknown but it is likely the snake is not adapted to prey upon spiny-rayed fish like bass and catfish. The Narrow-headed gartersnake is known to prey upon non-native trout, such as Brown and Rainbow trout.



**Figure 4.** Localities of fish communities in Gila dominated by native or non-native species, as detected during Narrow-headed gartersnake status surveys (Jennings et al. 2017, 2018, 2020). Red Stars indicate sites where native fish communities were dominant and the gartersnake was detected; Yellow Stars indicate sites where native fish were dominant but the gartersnake was not detected; and Blue Stars indicate sites where non-native fish were dominant and the gartersnake was not detected. There have been no sites where non-native fish dominate and the gartersnake has been detected.

### **Invasive Species**

Two non-native and highly invasive species are of significant concern. American Bullfrogs have been suggested to have extirpated the snake from historic localities such as Wall Lake in Catron County through direct predation on neonate gartersnakes (Jennings and Christman 2009). Crayfish can achieve incredible densities and prey upon the fish prey base of the Narrow-headed gartersnake as well as both neonate and, if the crayfish densities are high enough, adult gartersnakes (USFWS 2014). One current locality, Diamond Creek in Catron County, has seen a sharp increase in the density of crayfish while

seeing a sharp decrease in the number of observed neonate gartersnakes. Experts contracted with the Department have begun moving any Narrow-headed gartersnakes from Diamond Creek to a safer site nearby in Grant County (Jennings et al. 2020).

### **Disease**

Snake Fungal Disease (SFD), was detected in Narrow-headed gartersnakes in Arizona in 2019 (E. Nowak, Northern Arizona University, *pers. comm.*). SFD has been found in a few populations of snakes in the eastern United States, where conditions are much damper and therefore amenable to the fungus that causes the disease. However, given its aquatic life history, the Narrow-headed gartersnake is vulnerable should SFD arrive in the systems the gartersnake inhabits. The disease has wiped out several populations of Eastern massasauga rattlesnake and Timber rattlesnake and no treatment presently exists. No populations of Narrow-headed gartersnake have been lost in Arizona and SFD has not been detected in New Mexico as of this proposal.

### **Management actions taken on behalf of Narrow-headed Gartersnakes**

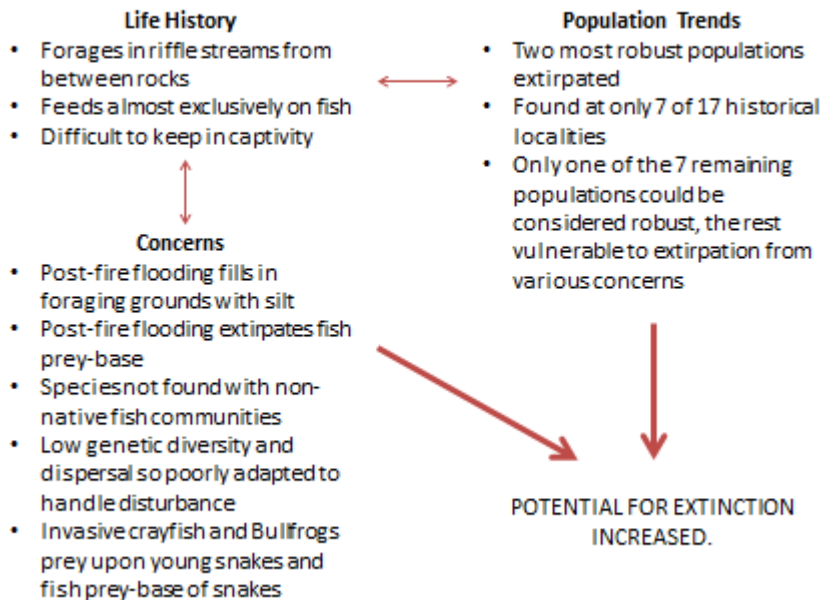
- 1990s, the large population at San Francisco Hot Springs was intensively studied by the Department prior to the extirpation of the species at that location.
- Early 2000s, a working group was formed in Arizona and New Mexico toward the conservation of Narrow-headed gartersnakes.
- In 2007 the State Game Commission approved a State Recovery Plan for the species (NMDGF 2007).
- In 2009 a long-term study of the one remaining robust population along the Tularosa River was started by contractors with the Department.
- In 2012 snakes were salvaged from Whitewater Creek in Catron County and moved to nearby Saliz Creek. Subsequent surveys indicate the species has survived the move and has reproduced there, suggesting translocation may be a viable recovery approach.
- In 2014 this species was listed as threatened by USFWS.
- From 2017 to present the Department has contracted experts to determine the status and trends of the remaining populations in New Mexico.
- In 2019 a rescue operation began to remove snakes from Diamond Creek, now overrun with invasive crayfish, and placing the snakes in a more secure situation. Radio-tracking was not feasible in 2019 but will start in 2020.
- In 2019 USFWS began the process toward the development of a federal recovery plan.

### **Recommendation to Uplist Status to State Endangered**

*Thamnophis rufipunctatus* should be uplisted to state endangered. The species is known to have been extirpated from a variety of sites such as Wall Lake and Heart Bar WMA (Jennings and Christman 2016, Christman and Jennings 2009), and two of the most robust populations in the state have been extirpated, San Francisco Hot Springs (Hibbitts et al. 2009) and Whitewater Creek (Christman and Jennings 2015). Surveys by experts under contract with the Department since 2017 have detected the species at only 7 of 17 known historical localities, of which only one, along the Tularosa River, is



considered robust (Jennings et al. 2017, 2018, 2020). Further, even as populations might be rediscovered, such as Blue Creek in 2018 and along the San Francisco River in 2019, given the overall pattern genetic isolation of the species those populations are very likely to be below necessary adaptive potential (Wood et al. 2018).



**Figure 5.** Overview of status of Narrow-headed gartersnake in New Mexico.

### Future Management Actions

The Department plans to continue studying the current status of this species in southwest New Mexico, as well as any necessary translocation efforts, including radio tracking translocated individual snakes. Wood et al. (2018) encourage translocation of populations to reduce the threat of genetic isolation and this should be examined. Although the population at San Francisco Hot Springs is considered to be extirpated, survey efforts should continue at nearby sites along the San Francisco River to obtain specimens that might be used to repopulate the Hot Springs area once the habitat and fish populations are suitable for the gartersnake. Given the detection of Snake Fungal Disease (SFD) in this species in nearby Arizona, monitoring for the fungal pathogen should be instigated, along with a plan for prevention of spread of the pathogen into the state and what should be done if SFD is detected in New Mexico. The Department should collaborate with stakeholders, including the Department’s Fisheries Management Division, concerning the issues of bullfrog and crayfish control and restoration of stream systems following wildfire, as invasive species and wildfire impact multiple species within a system. In addition, strict regulations regarding collecting should continue to be enforced. The Department should continue to support staff participation in the interagency Mexican and Narrow-headed Garter Snake Conservation Working Group.

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