

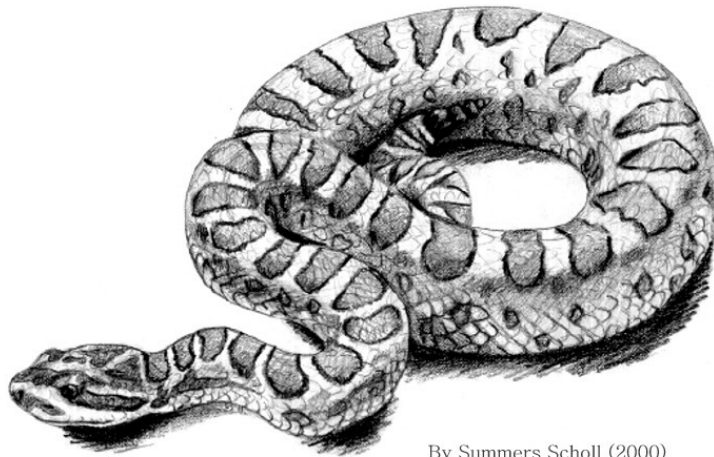
SPECIES ASSESSMENT FOR THE MIDGET FADED RATTLESNAKE (*CROTALUS VIRIDIS CONCOLOR*) IN WYOMING

prepared by

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Table of Contents

INTRODUCTION 2

NATURAL HISTORY..... 2

Morphological Description..... 3

Taxonomy and Distribution 4

Habitat Requirements 6

 General 6

 Area Requirements 7

Movement and Activity Patterns 7

Reproduction and Survivorship..... 8

 Breeding Behavior..... 8

 Breeding Phenology 9

Population Demographics..... 10

 Fecundity and Survivorship 10

 Limiting Factors 10

 Population Dynamics 11

 Genetic Concerns 11

Food Habits 12

 Food Items..... 12

 Foraging Strategy and Flexibility..... 12

CONSERVATION 13

Conservation Status..... 13

 Federal Endangered Species Act..... 13

 Bureau of Land Management 13

 USDA Forest Service 13

 State Wildlife Agencies..... 14

 Heritage Ranks and Wyoming Contribution Rank..... 14

Biological Conservation Issues..... 15

 Abundance in Wyoming..... 15

 Trends in Wyoming..... 15

 Range Context in Wyoming..... 15

 Intrinsic Vulnerability in Wyoming 15

 Extrinsic Threats and Reasons for Decline 16

 Protected Areas 16

CONSERVATION ACTION..... 17

Existing or Future Conservation Plans 17

INFORMATION NEEDS..... 18

TABLE AND FIGURES..... 19

 Table 1. Recognized subspecies of *Crotalus viridis*, the western rattlesnake 19

 Figure 1. Midget faded rattlesnake..... 19

 Figure 2. Map of current range of the midget faded rattlesnake 20

 Figure 3. Documented observations and predicted distribution of midget faded rattlesnakes in Wyoming 20

Introduction

The midget faded rattlesnake (*Crotalus viridis concolor*) has long been considered a subspecies of the western rattlesnake (*C. viridis*). This document will follow this convention, although there is some discussion of taxonomic revision at the species level that would categorize the midget faded rattlesnake as *C. oreganus concolor* (Crother et al. 2003). Midget faded rattlesnakes are a pale brownish gray, cream, or straw color. Blotches on the body are faded, subrectangular or sub-elliptical. As with most rattlesnakes, the most distinguishing feature is the rattle. Midget faded rattlesnakes are pit vipers, with the typical heat-sensing pits on each side of the head, between the eyes and mouth, used for detecting prey.

The midget faded rattlesnake mainly occupies the Colorado Plateau of eastern Utah, western Colorado, and southwestern Wyoming. Midget faded rattlesnakes are shy and inhabit rocky and arid basins. Exposed rock outcrops and ledges are important habitat features because they provide safe hibernacula, escape cover, and thermal cover.

While not listed as Threatened or Endangered by the U.S. Fish and Wildlife Service (USFWS), “take” of the midget faded rattlesnake is restricted in Wyoming by the Wyoming Game and Fish Department (WGFD). Although reliable population estimates have not been established, it is generally considered to be a rare taxon in Wyoming and across its range.

Natural History

The midget faded rattlesnake is currently considered a subspecies of the common western rattlesnake. The western rattlesnake occurs throughout the western United States, southern Canada, and northern Mexico (Klauber 1972, Stebbins 1985). The natural history of the midget

faded rattlesnake, including identifying characteristics and reproductive rates, is presented below. Most of this information comes from Woodbury (1929, 1958), Baxter and Stone (1985), Ashton and Patton (2001), Parker (2003), and Parker and Anderson (unknown date).

Morphological Description

As implied by the name, the midget faded rattlesnake (Figure 1) is notably smaller and paler than other forms of western rattlesnake. Adults reach lengths up to 75 cm (30 inches), but are more typically between 50 and 60 cm (20 to 24 inches); the typical western rattlesnake ranges up to 126 cm (64 inches) in length. Midget faded rattlesnakes typically weigh about 120 g (4.2 oz), with 200 g (7.1 oz) possible. They are sexually dimorphic in size, with males being larger than females.

Newborn midget faded rattlesnakes are 50 to 100 mm (2 to 4 inches) shorter than other western rattlesnake subspecies (Klauber 1972, Macartney and Gregory 1988, Diller and Wallace 1996). In addition, the average weight is about half of that reported for the larger subspecies.

Midget faded rattlesnakes are a grayish, pale color that is much lighter than other rattlesnakes. Coloration ranges from off-white to shades of light tan or light gray; blotches are usually faded in adults. Locally, the midget faded rattlesnake is sometimes called the “horseshoe rattler,” possibly in reference to the faded and rounded dorsal blotches. There are usually somewhat muted facial markings including dark bars with light colored edges that extend back from the eye to the corner of the mouth. Young are blotched and have prominent head and facial markings.

Scale rows usually number 23 at mid-body, ventrals 173, and caudals 24 (Baxter and Stone 1985). Scales are keeled and the anal plate is entire. As with all rattlesnakes, the tail terminates in a horny rattle. The number of tail rings indicate the number of molts.

Midget faded rattlesnakes produce a neurotoxic venom that disables the nervous system of its prey. The venom is generally considered non lethal to humans, but it appears to be one of the most dangerous and potent Crotalid venoms known (Glenn and Straight 1977). These snakes are generally non-aggressive if left alone.

Taxonomy and Distribution

This document proceeds on the assumption that the midget faded rattlesnake represents the concolor subspecies of *C. viridis*. However, it is recognized that some workers (Crother et al. 2003) classify the taxon as *C. oreganos concolor*.

There are nine subspecies of *C. viridis*, as listed in Table 1. *Crotalus viridis viridis*, the western or prairie rattlesnake, is the most widespread. The eight other subspecies are mostly named for the regions in which they are found, and include the Grand Canyon rattlesnake (*Crotalus viridis abyssus*), Coronado Island rattlesnake (*Crotalus viridis caliginis*), Arizona black rattlesnake (*Crotalus viridis ceberus*), midget faded rattlesnake (*Crotalus viridis concolor*), Southern Pacific rattlesnake (*Crotalus viridis helleri*), Great Basin rattlesnake (*Crotalus viridis lutosus*), and Hopi rattlesnake (*Crotalus viridis oreganus*) (Hammerson 1982, Stebbins 1985, Cox and Tanner 1995).

The entire range of the midget faded rattlesnake lies within the Green River Formation of Wyoming, Utah, and Colorado (Parker 2003) (Figure 2; see also Figure 3). The Green River Formation is a unique geological formation that is a result of three prehistoric lakes that dried up 40-50 million years ago. Many prehistoric and modern rivers have cut through the strata exposing a matrix of rock outcrops throughout the formation. Midget faded rattlesnakes typically occur

below 7,000 ft elevation. The subspecies' distribution appears to be limited by the occurrence of rock outcrops used for various life activities, particularly hibernation.

The midget faded rattlesnake differs from other Wyoming rattlesnakes on many levels, including behavioral and demographic differences. These differences support new phylogenetic data that suggest a more distant relationship, possibly even full-species status (Pook et al. 2000, Ashton and de Queiroz 2001, Douglas et al. 2002). Although *C. v. concolor* and *C. v. viridis* are currently separated by little geographic distance in Wyoming, they were probably much more isolated during glacial periods when greater divergence could have occurred.

Throughout most of their range midget faded rattlesnakes are the only rattlesnakes present; even at range margins they are usually easy to distinguish from other subspecies. To the south they begin to intergrade with *C. v. nuntius* and *C. v. viridis*; in south-central Wyoming and northwest Colorado there may be limited intergradation with *C. v. viridis* (Hammerson 1999, Stebbins 2003).

Midget faded rattlesnakes tend to associate with south to southeast facing rock outcrops, and are most easily found there between 0800-1100 hours. Larger adults may use adjacent sagebrush communities to hunt during the warmest months of the year (July/August) but are nearly impossible to locate during such behavior. Gravid females remain close to the den site throughout the active season, while non-gravid females likely move more in search of prey.

Habitat Requirements

General

In general, midget faded rattlesnake habitat can be defined as high, cold desert dominated by sagebrush (*Artemisia* spp.) and with an abundance of rock outcrops and exposed canyon walls. Greasewood (*Sarcobatus vermiculatus*), juniper (*Juniperus scopulorum*), and other woody plants occur secondarily, or occasionally as co-dominants or even dominants, in some areas. Juniper woodlands are more common at higher altitudes.

The focal points of midget faded rattlesnake populations are rock outcrops that provide escape cover, thermal cover, and especially hibernacula. Throughout the subspecies' range the warm season is relatively short and winters are long and cold; thus, appropriate outcrops are crucial for reproduction and survival. Suitable outcrops typically include multiple den chambers.

Midget faded rattlesnakes den in groups that range up to 100 individuals in size. The distribution of outcrops suitable for denning is likely the primary driver of distribution of midget faded rattlesnakes in Wyoming, where the subspecies reaches its northern limits (Parker 2003). Den site fidelity is rather high. In Wyoming, midget faded rattlesnakes emerge from hibernation in April and May and remain near the den entrance for 2 to 3 weeks. Initial movements locate “shedding habitat”, which is characterized by large flat rocks used to assist in molting. Most adults shed just once each year. Shedding can last 2 to 3 weeks, during which time the snakes remain sedentary.

Once molt is complete, adult males and non-gravid females migrate an average of 2,122 m and 1,956 m, respectively. Gravid and post-partum females typically migrate only 297 m. These movements vary from straight-line to fixed angle to somewhat random in nature. Juveniles tend to

remain at rock outcrops associated with the den. Gravid females also remain at such formations throughout the year and are sedentary until parturition (Parker 2003).

Aggregating behavior is common in midget faded rattlesnakes. Similar to the western rattlesnake, they commonly aggregate during gestation. Young aggregate with their mother for approximately 1 week after birth, until after their first shed. Parker (2003) speculated that aggregating behavior is an adaptation to rather severe environmental pressures during these vulnerable periods; predator defense, as well as osmo- and thermoregulation, are enhanced in aggregations.

Area Requirements

Gravid females move only a short distance, typically less than 20 m, from their hibernaculum upon emergence. By comparison, males and non-gravid females have some of the longest migrations and largest activity ranges reported for rattlesnakes (Parker 2003). The midget faded rattlesnake has disjunct winter/spring and summer activity ranges, with lengthy migrations between the two areas, again illustrating the importance of denning habitat and the need to be close to it as cold weather approaches. While on summer range, the snakes make much shorter and more random movements associated primarily with hunting.

Movement and Activity Patterns

The active season for the midget faded rattlesnake is relatively short, lasting only 4-5 months (followed by a 7-8 month hibernation). Breeding occurs soon after they emerge from hibernation in early May; parturition usually occurs from mid-August into early September. Gravid females move only a short distance (<20m) from their hibernaculum upon initial emergence (Ashton and Patton 2001); they may even remain under the same rock until well after parturition. They may do

this alone or join in an aggregation, or “rookery”, of other gravid females. They usually return to hibernacula in late October to early November.

Adults and young bask in the morning sunlight until their body temperature reaches the low 90’s (F) at which time they retreat into the shade, usually of a rock, for the rest of the day. Adults tend to hunt mostly in the evening and early nighttime, while juveniles tend to hunt throughout the day because they lose body heat faster than the larger adults after sunset (Parker 2003).

Reproduction and Survivorship

Breeding Behavior

Mating occurs in July and August (Ashton 2003), similar to the western rattlesnake (King and Duval 1990, Aldridge 1993). Females give birth to live young from mid-August into September. It is not uncommon to find small aggregations, or rookeries, of gravid females during this time.

Most gravid females stay at or near the hibernaculum. Parturition typically allows mother and young one month to forage before hibernation. Neonates are born at the den and spend the first winter in the same hibernaculum as their mothers. The females emerge the following spring in an emaciated condition due to the cumulative weight loss during gestation, parturition, and overwintering (Macartney and Gregory 1988). Subsequent mating depends on body mass recovery, but body mass recovery is not the only factor because some rattlesnakes with similar weight gains do not necessarily mate. The result is reproductive cycles that are biennial, triennial and quadrennial, with triennial apparently the most common (Macartney and Gregory 1988). Annual cycles could occur only if there was sperm storage, because the time between mating and parturition is more than one year. Therefore, in any given population segment there are juvenile

females, gravid adult females, post-partum females that may or may not mate, and newly sexually mature females that may or may not mate.

Breeding Phenology

Female midget faded rattlesnakes in Wyoming give birth earlier in the year than most conspecific populations, but the timing is similar to those conspecifics from environments with similar temperatures. Parturition dates generally are earlier for western rattlesnakes that experience lower mean temperature environments (Ashton and Patton 2001). This adaptation makes sense, since snakes in cooler climates have shorter active seasons and need to give birth prior to hibernation.

Like all rattlesnakes *C. v. concolor* is ovoviviparous, meaning eggs are incubated internally and young are born already hatched. At birth young are fully developed and prepared for immediate independence. However, young usually stay with their mother for up to a week until they shed. Clutch size is relatively small, probably due to overall small size of adults; clutches average 3 to 4 young, rarely ranging up to 7.

Sex ratio of Wyoming populations of midget faded rattlesnakes is highly skewed toward females (J. Parker, personal communication). It is estimated that age at first reproduction for females is at least 5 years, and may be closer to 10 years (Parker 2002). Once they've reached this age, females reproduce every 3 years; reproduction every 2 years may occasionally occur.

Population Demographics

Fecundity and Survivorship

Clutch size in particular, and reproductive output in general, is rather low because adult females are small and the growing season is short (Graves and Duvall 1993, Farrell et al. 1995, Ashton and Patton 2001). Reproduction largely depends on resource availability and the ability to convert resources into fat reserves, which in turn vary strongly with climatic conditions. Mean clutch size for most rattlesnakes is 7.6 - 8.2, and the proportion of gravid females in populations is highly variable. Mean clutch size for midget faded rattlesnakes, by comparison, is 3- 4, with the percentage of gravid females ranging 14-52% and an average of 25% (Parker 2003).

It is unknown how long midget faded rattlesnakes survive in the wild; however, similar species have been reported to live as long as 18 years (Martin 2002). A variety of carnivores prey on midget faded rattlesnakes, with badgers (*Taxidea taxus*) being the primary predator (Parker 2003). Raptors, canids, and skunks feed on the snake as well. Annual mortality rates are unknown, and population trends will remain unknown until more detailed monitoring is conducted. Some genetic data suggest the Wyoming population could be in decline (Parker 2003).

Limiting Factors

Rock outcrops that provide cover and (perhaps most importantly) effective hibernacula appear to be the main environmental limit to distribution and abundance of midget faded rattlesnakes. The effect of predation is not known. External parasites have been found on the snake; however such parasites usually are not major sources of mortality because they are eliminated with each shedding. No diseases have been documented in this subspecies.

Human-caused mortality is probably a very important limit locally, especially if it occurs at or near den sites when snakes are aggregating. Road kill is thought to be a significant source of mortality, but there is little hard data on this topic. There have been anecdotal reports of reptile collectors seeking aggregations of midget faded rattlesnakes to capture and sell into the pet market; again, unregulated collecting near den sites could have large impacts on the population.

Population Dynamics

Midget faded rattlesnakes exist in relative small populations throughout their range. Larger populations seem to persist, while smaller populations may periodically go extinct and then become re-colonized. While population estimates are not available, population growth is thought to be slow for the following reasons:

- Age at first reproduction for females is at least 5, possibly 10 years
- Clutch sizes average only 3-4 young
- Females reproduce only once every 3, occasionally 2, years
- Recruitment is unknown, but likely low given observed adult-to-yearling ratios

Genetic Concerns

When compared to other rattlesnake populations, midget faded rattlesnakes in Wyoming were relatively diverse genetically (Parker 2003). Although Flaming Gorge Reservoir and the Green River split the Wyoming population into 2 geographic centers, genetic analysis suggests that there is no barrier to gene flow between the centers. However, the reservoir was in place only for 7-8 snake generations (established in 1964) prior to the genetic study; it may be that Flaming Gorge Reservoir has yet to prove itself as a genetic barrier for midget faded rattlesnakes (Parker 2003).

The relatively high genetic diversity of the Wyoming population may be due to one of two possibilities. Either the population used to be more widespread and abundant and has since contracted to its current patchy pattern (thus genetic diversity is a preserved artifact of a larger past population), or the population has long persisted in a patchy pattern and genetic diversity is maintained by very rare exchange of individuals between subpopulations. It is difficult to distinguish between the 2 scenarios without further study. If the first scenario is true, managers and conservationists should be concerned about further erosion of genetic diversity as inbreeding and other deleterious small-population effects increase.

Food Habits

Food Items

The primary diet for midget faded rattlesnakes consists of most small mammals (e.g., *Peromyscus* spp.), and the few lizards that share their habitat including the northern sagebrush lizard (*Sceloporus graciosus*), northern plateau lizard (*Sceloporus undulatus*), and northern tree lizard (*Urosaurus ornatus*). Larger adults tend to take larger rodents and even some birds.

Foraging Strategy and Flexibility

These snakes tend to be prey generalists that will consume anything within gape size and reach (Parker 2003). Small mammals are the primary prey; however, small mammal abundance does not explain midget faded rattlesnake occupation of specific habitats (Parker 2003).

The midget faded rattlesnake is believed to be rare throughout its Wyoming range (Baxter and Stone 1985), but this may be an artifact of cryptic coloration and shy behavior. Most snakes probably go undetected and retreat from potential observers without rattling.

Parker (2002) roughly estimated numbers of midget-faded rattlesnakes in Wyoming. He encountered 426 snakes, and radio-collared 50, during his study. Assuming this represents approximately 5% of the state population, an estimated 8,000 - 10,000 snakes occupy Wyoming.

Conservation

Conservation Status

Federal Endangered Species Act

The USFWS does not give any special status to midget faded rattlesnakes at this time.

Bureau of Land Management

The Colorado and Wyoming State Offices of the USDI Bureau of Land Management (BLM) each list the midget faded rattlesnake as a Sensitive Species. The BLM developed this designation to “ensure that any actions on public lands consider the overall welfare of these sensitive species and do not contribute to their decline.” Sensitive species management will include: determining the distribution and current habitat needs of sensitive species; incorporating sensitive species in land use and activity plans; developing conservation strategies; ensuring that sensitive species are considered in National Environmental Policy Act analyses; and prioritizing necessary conservation work (USDI Bureau of Land Management 2001).

USDA Forest Service

At present the USDA Forest Service (USFS) does not consider the midget faded rattlesnake to be a sensitive species. However, in this context it is important to note that the Ashley National Forest (USFS Region 4) manages Flaming Gorge National Recreation Area, which supports the subspecies.

State Wildlife Agencies

The Wyoming Game and Fish Department restricts intentional take of the midget faded rattlesnake in Wyoming, unless deemed necessary by unusual circumstances; see Chapter 52, Section 11 of Wyoming Game and Fish Commission Regulations. The Utah Division of Wildlife Resources lists all subspecies of the western rattlesnake as controlled species requiring permits for take. Similarly, the Colorado Division of Wildlife requires permits for the take of midget faded rattlesnakes, but also lists the subspecies as sensitive within Colorado.

Heritage Ranks and Wyoming Contribution Rank

The midget faded rattlesnake has been assigned a rank of G5/T3/S1 by the Wyoming Natural Diversity Database (WYNDD, University of Wyoming; Keinath et al. 2003). The G5/T3 rank indicates that although the full species *C. viridis* is apparently secure rangewide, the subspecies *concolor* is at moderate risk of extinction across its range. The S1 rank indicates the subspecies is at relatively high risk of extinction from the state of Wyoming. It is important to note that these rankings are based on very limited field data.

The Wyoming Contribution rank for midget faded rattlesnake is High. This is based on a ranking system developed by WYNDD (Keinath and Beauvais 2003) that measures the contribution of Wyoming populations of a taxon to the rangewide persistence of that taxon, and considers several factors. For the midget faded rattlesnake these factors include: (1) the subspecies is a resident native in Wyoming, (2) the subspecies has a restricted continental range, (3) the state encompasses a large percentage of that continental range, and (4) the status of Wyoming populations relative to populations in other areas is unknown.

Biological Conservation Issues

Abundance in Wyoming

A rough estimate of the number of midget faded rattlesnakes in Wyoming is about 10,000 individuals (Parker 2002), but confidence in this estimate is low due to lack of information on some of the most basic life history parameters. Reported occurrences for the midget faded rattlesnake in Wyoming are all in the Green River Basin, near Flaming Gorge Reservoir in southwestern Wyoming (Figure 3).

Trends in Wyoming

The population trend in Wyoming is unknown due to lack of data. Some genetic testing suggests that the population is declining (Parker 2003).

Range Context in Wyoming

The midget faded rattlesnake occupies only a small portion of southwest Wyoming (Figure 3). This is the northern-most extent of the species range, which extends south into Colorado and southwest into Utah.

Intrinsic Vulnerability in Wyoming

A variety of factors contribute to a taxon being intrinsically vulnerable to decline and extinction, including low or variable population density, large area requirements, low fecundity, habitat specificity, and site fidelity. Midget faded rattlesnakes exhibit all of these characters. Low reproductive potential and high habitat specificity, especially in relation to particular rock outcrops that provide adequate hibernacula, are probably the most important characters in this context.

Extrinsic Threats and Reasons for Decline

It is likely that episodic natural disturbances, such as wildfire and summer cold-snaps, periodically reduce *C. v. concolor* populations. More persistent sources of mortality are predation and vehicle collisions. Road-kill may be a very large source of mortality in Wyoming; note that snakes are attracted to roads as a basking surface. Petroleum exploration and development, and its attendant road building, have the potential to eliminate some local populations, as does unrestricted motorized recreation.

Legal and illegal collection of midget faded rattlesnakes for the pet trade has likely reduced, and maybe even eliminated, some local populations. The subspecies is internationally popular as an exotic pet and, if uncontrolled, market collection could be one of the greatest risks to the subspecies in the wild. Ironically, deliberate killing of rattlesnakes by people has probably also reduced some local populations.

The construction of Flaming Gorge Reservoir has probably reduced the viability of midget faded rattlesnake populations in Wyoming. The reservoir likely flooded much suitable habitat and has probably reduced, if not eliminated, most of the east-west gene flow in the state.

Protected Areas

Currently there are no protected areas occupied by the midget faded rattlesnake in Wyoming. Most of the subspecies' range in the state falls on USFS, BLM, or state lands managed for multiple-use, with an emphasis on recreation, livestock production, and mineral development.

Conservation Action

Existing or Future Conservation Plans

There are no formal conservation plans specifically targeting the midget faded rattlesnake. Conservation recommendations presented by midget faded rattlesnake researchers in Wyoming are listed below (Parker and Anderson, date unknown).

Recommendations regarding present or anticipated activities - Those responsible for or undertaking land development and recreation should be provided information to help reduce negative impacts on midget faded rattlesnakes. Many organizations or parties involved in these activities are not aware of the uniqueness of the subspecies or the potential negative effects of their actions. This holds for federal land managers, such as the USFS and BLM, as well as others.

Areas recommended for protection—Areas that fit the critical habitat description for *C. v. concolor* - namely, expanses of cold desert <7000 feet elevation on the Colorado Plateau with rock outcrops suitable for hibernacula - should be protected from destructive activities once they are determined to be occupied by the subspecies.

Habitat management recommendations— Once occupied sites are identified, core rock outcrops should also be identified and adjacent lands within at least one-half mile of these features protected from all surface and subsurface disturbances. Roads may need to be moved or closed if road-kill is determined to be a major source of snake mortality.

Other recommendations—Although there is not enough information available yet to confidently determine the conservation status of *C. v. concolor*, observed life history traits suggest that these rattlesnakes are very sensitive to anthropogenic and natural disturbances. Until more

information is available, all disturbance of critical habitat should be avoided. Commercial collection permits should not be distributed, and illegal collection should be combatted.

Information needs

Following Parker and Anderson (date unknown): research into demography, habitat use, and influence of anthropogenic disturbances on midget faded rattlesnakes is underway. These studies will yield valuable information and should be continued. Basic field inventories that delineate the true distribution of the subspecies, and its boundaries with adjacent subspecies, are also needed, as are further genetic studies that map population connectivity and inform debates over species- and subspecies-level taxonomy.

Table and Figures

Table 1. Recognized subspecies of *Crotalus viridis*, the western rattlesnake.

Common Name	Scientific name	Description	Location
Grand Canyon	<i>C. v. abussus</i>	Reddish above, blotches obscure	Grand Canyon, Arizona
Arizona Black	<i>C. v. cerberus</i>	Dark gray, brown or almost black above, large dark blotches partially bordered by white scales	Arizona south of the Colorado Plateau into western New Mexico
Midget Faded	<i>C. v. concolor</i>	Pale yellow, blotches obscure or absent	Wyoming, Colorado, Utah
Southern Pacific	<i>C. v. helleri</i>	Resembles Arizona Black, diamond-shaped blotches completely bordered by light scales	San Louis Obispo and Kern counties, CA, south to Baja CA
Great Basin	<i>C. v. lutosus</i>	Light brown or gray above, blotches narrow	Oregon, Idaho, California, Nevada, Utah, Arizona
Northern Pacific	<i>C. v. oregonus</i>	Resembles Southern Pacific, blotches oval or hexagonal, well-defined tail rings	British Columbia, Washington, Idaho, Oregon, Sierra Nevadas in California
Prairie or Western	<i>C. v. viridis</i>	Greenish-yellow or olive with large rounded blotches on the body.	Canada to Mexico, east to Kansas
Coronado Island	<i>C. v. caliginis</i>	No description found	Mexico
Hopi	<i>C. v. nuntius</i>	Light in color with indistinct markings. Thick bodies with slender necks, diamond shaped head.	Northeast Arizona to Extreme Southeastern Utah

Figure 1. Midget faded rattlesnake. *Photograph by Joshua Parker.*



Figure 2. Map of current range of the midget faded rattlesnake. (Map is from Natural Toxins Research Center, Texas A & M University-Kingsville).

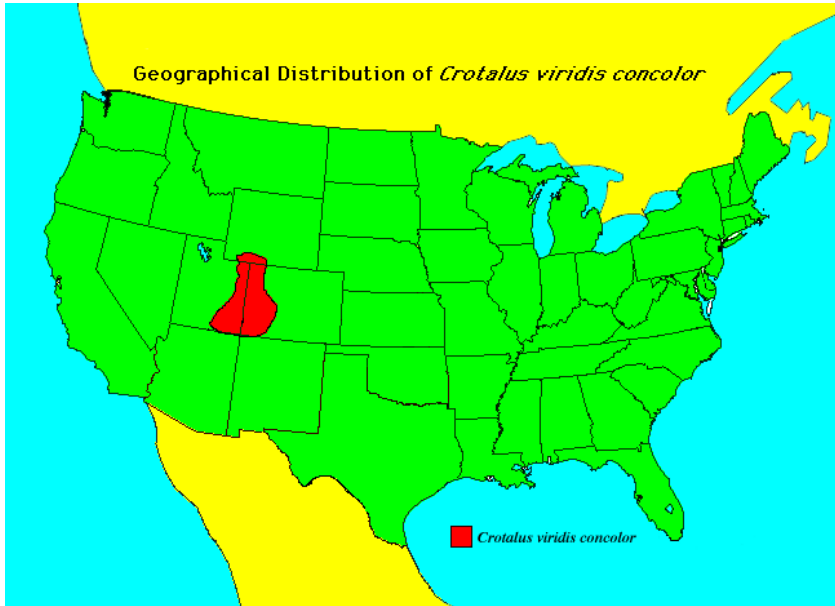
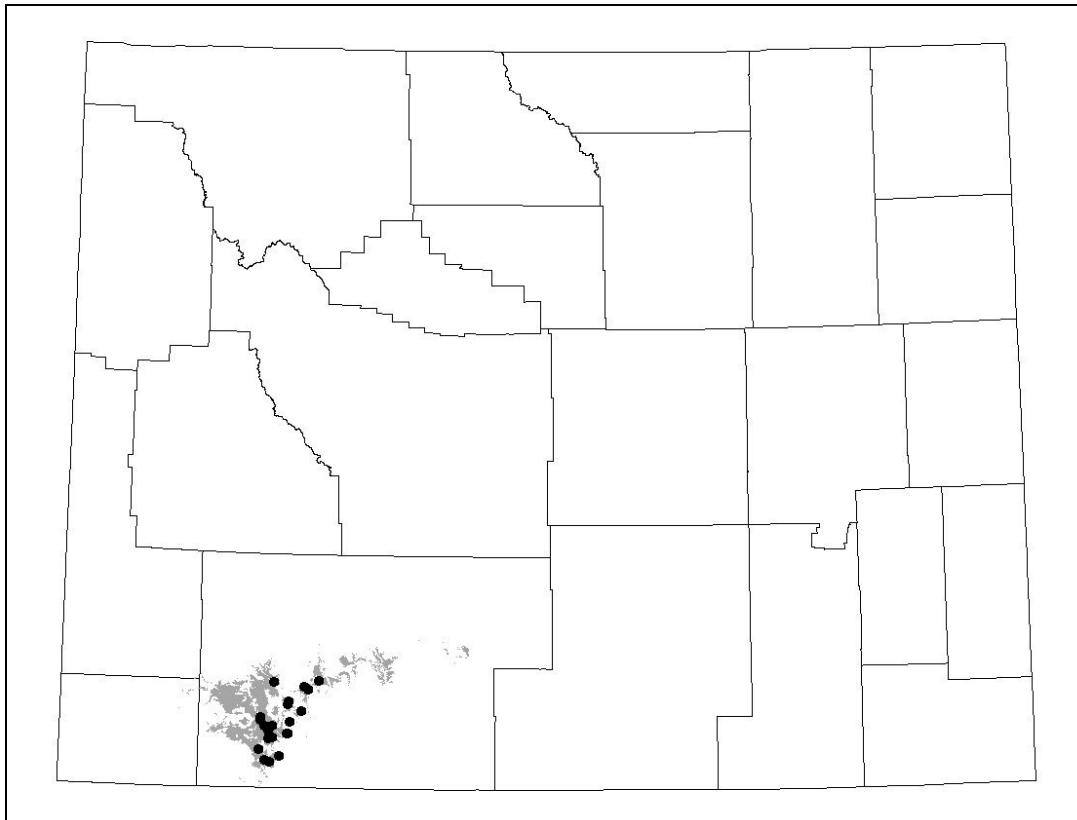


Figure 3. Documented observations (black dots) and predicted distribution (gray shading) of midget faded rattlesnakes in Wyoming. Data on file at the Wyoming Natural Diversity Database (University of Wyoming, Laramie, Wyoming).



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