AN ASSESSMENT OF POTENTIAL HABITAT AND DISTRIBUTION OF THE GRAY-BANDED KINGSNAKE (LAMPROPELTIS ALTERNA) IN NEW MEXICO

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INTRODUCTION

The gray-banded kingsnake occurs in the Chihuahuan Desert of Mexico and the United States of America from at least the Anticline of Arteaga, Mexico north through much of the Mapimian portion of the Chihuahuan desert (Garstka 1982). The species was originally described from a specimen found in the Davis Mountains of Texas (Flury 1950). A specimen from Val Verde County, Texas was initially described as a separate species, Lampropeltis blairi, but the two forms were found to be conspecific color variants (Gehlbach and McCoy 1965). The gray-banded kingsnake has at various time been described as a subspecies of Lampropeltis mexicana, but is currently afforded specific status as a close relative of Lampropeltis mexicana, which is found south of the anticline of Arteaga, and Lampropeltis ruthveni, which is a montane form from central Mexico. The status of the gray-banded kingsnake as a species is still open to debate, and will require additional specimens from the contact zone for clarification.

Garstka (1982) has found that kingsnakes of the Lampropeltis mexicana species group, which includes L. alterna, mimic sympatric Crotaline models presumably to avoid predation. The gray-banded kingsnake was once thought to be two distinct species within the United States known as Lampropeltis alterna (Brown) and Lampropeltis blairi (Cope). Lampropeltis alterna was described as having 17-23 narrow black bands sometimes split with red, with secondary banding or spotting between the primary bands (Mecham and Milstead 1949). Lampropeltis blairi was described as having from 9-18 wide black-edged orange or red saddles on a gray to black background (Flury 1950). Gehlbach and Baker (1962) reported both forms coming from a single clutch of eggs. Since that time, an astounding variety of colors and patterns have been found to exist in both wild and captive populations of gray-banded kingsnakes (Miller 1979).

Lampropeltis alterna is a secretive, nocturnal, medium-sized colubrid that is found in the United States from the Balcones Escarpment of the Edward's Plateau in Texas westward through Trans-Pecos Texas to the Hueco Mountains in El Paso County (Miller 1979). It inhabits a variety of habitats, but is found primarily in rocky desert hills at medium elevations. This species is rigorously pursued by reptile enthusiasts ranging from private and commercial collectors to zoos and scientific institutions. Prices have ranged from highs of over $500 per animal in the early 1970's to a low of around $75 per animal in the mid 1980's. Prices for captive bred hatchlings currently range from $100 to $200 depending on the source and the color and pattern of the specimen. Specimens from areas that are not well represented in private collections can still bring substantially higher prices. Hundreds of gray-banded kingsnakes are currently maintained and bred in private collections in New Mexico and throughout the United States.

The only scientific specimen of Lampropeltis alterna from New Mexico was collected by Gary Swinford in Walnut Canyon, Guadalupe Mountains, Eddy County, New Mexico (Swinford 1991). This location is within the Carlsbad Caverns National Park. The specimen was found alive on the road in June of 1991. Rumors of other specimens from New Mexico have occasionally floated through the amateur herpetological community.

METHODS

The purpose of this research was to assess the potential distribution and habitat of the gray-banded kingsnake in New Mexico by a variety of methods. First, a literature and museum record search was made to identify locations of occurrence and determine elevational limits and habitat associations in both New Mexico and adjacent counties in Texas where gray-banded kingsnakes are known to occur. This data was used to map the probable range of the species in New Mexico by extrapolation to maps of vegetation types and topography in southern New Mexico. I attempted to include soil type analysis, but soil surveys have not been completed for most of the counties in Texas where gray-banded kingsnakes occur, so I was not able to attain much useful information from soil surveys. The soil survey for El Paso County, Texas was helpful, which will be discussed later in this section. I also mapped the range of the Texas banded gecko (Coleonyx brevis) from museum records with the hope that these animals may have enough overlap in range and habitat types to enable the use of the gecko as a predictor for occurrence of the gray-banded kingsnake.

I interviewed amateur and professional herpetologists who have collected snakes in southern New Mexico and west Texas to determine other potential localities of additional specimens from New Mexico. There were enough rumors of additional specimens having been found in New Mexico to assume that at least some of them were probably true. Because of my position as a member of the amateur herpetological community, I hoped to obtain information on such specimens more easily than a law enforcement person or a strictly scientific investigator might. I also acquired or viewed photographs of other specimens purported to be from New Mexico.

Finally, I attempted to find gray-banded kingsnakes in New Mexico through field sampling. I searched for the animals in four localities by driving paved and unpaved roads at night, and searching the roadway in the headlights. I also searched adjacent road cuts and cliffs using a 500,000 candlepower hand-held spotlight.

RESULTS

Literature and Museum Search

I conducted a literature search of Biological Abstracts, Wildlife Abstracts, Wildlife Review, Ecological Abstracts, Herpetological Review, Herpetologica, and Copeia. Hyder (1993) reported that he thought he had seen a record of a gray-banded kingsnake from the Carlsbad, New Mexico area in an article from around 1930. I was not able to find any additional reports in the scientific literature of additional specimens of Lampropeltis alterna from New Mexico.

Museum records of gray-banded kingsnakes were obtained from 10 museums out of over 30 from which I requested information. Map 1 shows that portion of west Texas where most gray-banded kingsnakes have been collected, with museum record information plotted. I had originally begun mapping both Texas banded gecko and gray-banded kingsnake specimen localities on this map, but it soon became apparent that the geckos are much more widespread than the kingsnakes, ranging over 100 miles farther eastward to the vicinity of San Antonio. The gecko has also been recently found in central New Mexico, over 100 miles northwest of the nearest known locality for the gray-banded kingsnake (Painter 1994). While the

entire range of both species can be characterized by broken rocky soils, the gray-banded kingsnake does not occur much higher in elevation than the lower limit of the juniper zone, whereas the geckos are found well into densely forested habitats in Texas. Other than this difference, the locations where Texas banded geckos occur are also usually locations where gray-banded kingsnakes occur. Because of the much wider distribution of Texas banded geckos, however, and their existence in habitats that apparently aren't suitable for gray-banded kingsnakes, the Texas banded gecko is likely not a good indicator of potential gray-banded kingsnake habitat by itself, and must be weighed with other habitat characteristics. Texas banded geckos are found in habitats characterized by much smaller rock sizes than gray-banded kingsnakes use, and it seems like the size of rocks and slope are more important to the kingsnakes than to the geckos. There is potential to use advanced statistical methods such as multiple regression analysis to develop a predictive model for Lampropeltis alterna habitat that may include these three parameters as important predictive components, but that would be well beyond the scope of this study.

There are two areas in Texas where gray-banded kingsnake records are abundant. The first is the low elevation limestone country in the vicinity of Langtry and Comstock. This is the area where most specimens of Lampropeltis alterna have been taken, both by scientists and amateur snake collectors. Miller (1979) estimated that in the 1970s, over 100 of these animals were taken each year from this area while less than 50 were taken from the remainder of their range in Texas. The map of scientific records for this area became so cluttered that I had to stop recording museum numbers and eventually even specimen localities as the map became a single line of overlapping locality records that became impossible to differentiate. I took a trip early in this study to this area to assess the habitat. The gray-banded kingsnakes in Val Verde, Terrell, southeastern Pecos, and eastern Brewster Counties occur throughout a wide area of steep, broken limestone, with most specimens coming from below 3,000 feet in elevation below the juniper zone. Although this limestone habitat appears extremely similar to that over much of Trans-Pecos Texas, there appear to be two easily discernable differences. The first is the elevation. There is very little habitat west and north of this area that is under 3000 feet above mean sea level. The second important difference is in humidity. While the entire portion of West Texas from the edge of the Edwards Plateau is hot desert, frontal storms coming north from the Gulf of Mexico, which provide the high humidity and rainfall to coastal and Central Texas, often have their western edge right along the Langtry area. This higher humidity makes for better conditions for nocturnal reptile activity since it allows these animals to be active for longer periods without risking significant desiccation, and it moderates the rate of temperature fluctuation, maintaining longer periods of optimum activity temperatures. The higher elevations of West Texas are drier and cool much more quickly at night, so nocturnal reptiles probably stay underground more to maintain both body moisture and body temperature.

In the Langtry and Comstock area, most gray-banded kingsnakes are found climbing on road cuts where the limestone hills have been blasted away to maintain the appropriate grade on the highway. A few specimens are found crossing paved or dirt roads, but almost always in the immediate vicinity of limestone cliffs. The number of private collectors working the area around Comstock and Langtry in June of 1993 was appalling. Dozens of vehicles were driving the paved roads from sunset to 3:00 or 4:00 in the morning, while dozens more were spotlighting road cuts. I would estimate that around 100 private collectors from all over the

United States were pursuing these snakes relentlessly. While it disturbed me to see such heavy use of a natural resource, this level of effort may have important implications to gray-banded kingsnakes in New Mexico which will be discussed in the Conclusions Section of this report.

The other area that has produced significant numbers of gray-banded kingsnakes is the Rio Grande River road between Study Butte and Presidio. Once again, most specimens from this area are from below 3,000 feet in elevation. The habitat is similar to the area around Langtry and Comstock, but the rock types are predominantly igneous, with some limestone intermingled. Although this area is drier than the Langtry/Comstock area, the river canyon where the majority of specimens have been found is also characterized by higher humidity than the surrounding desert as a result of evaporation from the river and transpiration from the riparian vegetation. Map 1 shows that the locality records from the Rio Grande River canyon road are significantly concentrated like those around Langtry, although both the total number and density of records are lower.

Map 2 shows locality data for museum records of Lampropeltis alterna in northern Trans-Pecos Texas and New Mexico. The only record from New Mexico is MSB 52,000, which is the animal collected by Gary Swinford in July of 1991.

The records on this map are few and far between. There is no rock outcrop habitat on this map that is below 3,000 feet in elevation and with a source for high humidity like the two areas where most gray-banded kingsnakes have been found. It is obvious that outside humidity is therefore not critical to the species' occurrence in an area. However, humidity is probably a critical factor in determining the amount of time these animals will be active on the surface in a given area. The highest elevation record for the species is also one of the most northern, UTEP 542, which is from 5700' near Pine Springs in the Guadalupe Mountains National Park. This area has higher precipitation and relative humidities than much of the Trans-Pecos region, and has perennial streams in an oak-juniper woodland habitat type. The National Park is also not grazed by domestic livestock in sharp contrast to most of the surrounding desert, so vegetative cover is much more dense, which also increases subsurface soil moisture and ground level humidity. However, this high elevation area cools quickly at night, and temperatures can drop rapidly following summer thunderstorms.

The westernmost records for the species are UTEP 874, 2866, and 9404 from the Hueco Mountains. These records are extremely significant when extrapolating habitat associations into New Mexico, because soil surveys have been completed for El Paso County, Texas. These records are all from the Limestone rock land-Lozier association soil types in the Hueco Mountains. This soil type is typical of much of the broken limestone country in Otero and Eddy Counties, New Mexico.

The expected range of Lampropeltis alterna in New Mexico based on extrapolation of museum records and contiguous habitat is shown on map 3. The habitat of this species seems to be restricted to steep to precipitous hills and mountains between approximately 4,000 and 5,700 feet in elevation, below the juniper zone. This habitat is found in Otero, Eddy, and extreme southwestern Chavez Counties in low desert hills and the Guadalupe and southern Sacramento Mountains.

Interviews With Collectors

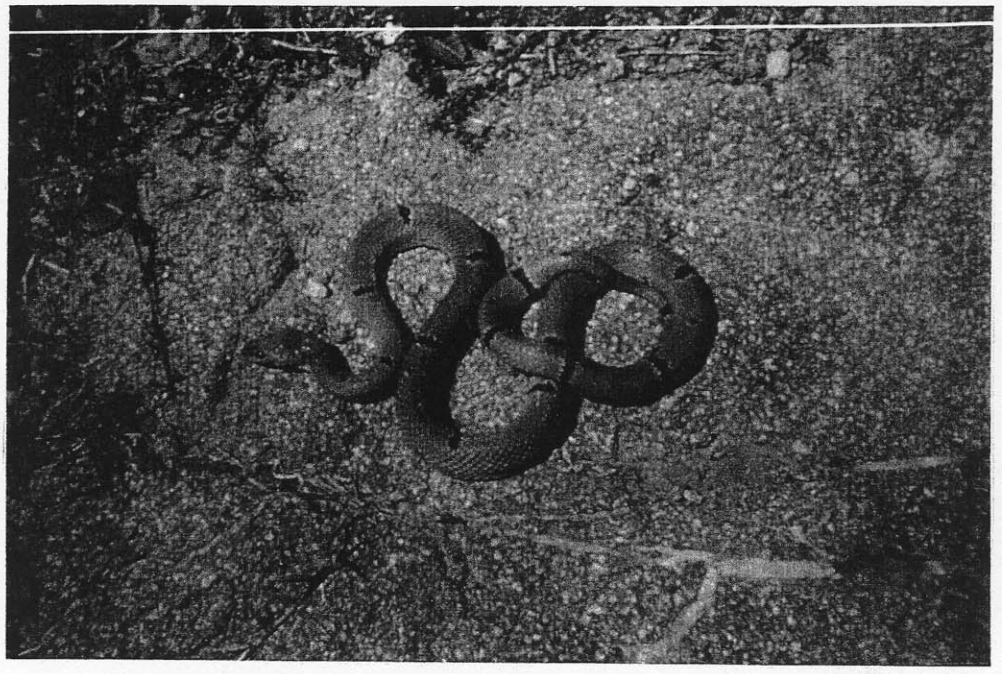
There is a substantial network of people nationwide who pursue gray-banded kingsnakes in Texas, some of them making yearly or even more frequent trips to the Langtry area. Some of these people have become elitists who try to breed animals from a specific locality, even a specific road cut together to produce "pure" animals. These hobbyists call themselves locality breeders, and there is a very tight and tight-lipped community of these people who consider themselves experts on what gray-banded kingsnakes look like from a given area, and who caught gray-banded kingsnakes in specific areas at specific times. I have contacted some of the people who consider themselves to be such experts in seeking information on possible additional specimens of the gray-banded kingsnake from New Mexico.

It is important to understand that there may not be a "typical" specimen from any given area. The species is incredibly variable within all known populations, although there are trends in color and pattern that may dominate within a certain population. Picture 1 shows the specimen collected in New Mexico by Gary Swinford.

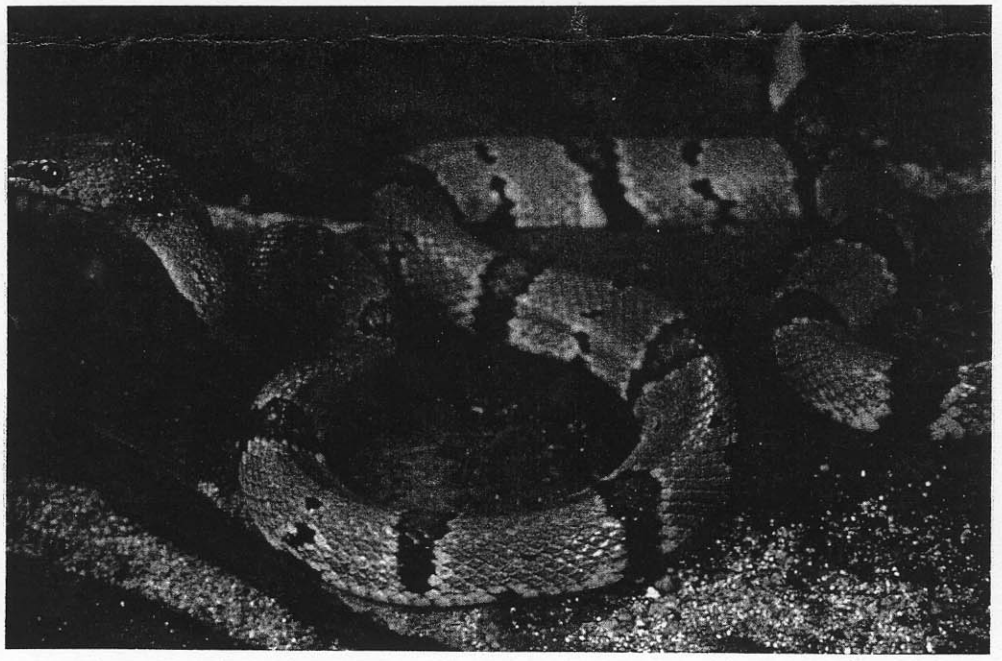
Picture 1. Lampropeltis alterna from Walnut Canyon, Eddy County, New Mexico. Copyrighted material reproduced with the permission of Gary Swinford.

This animal exemplifies what most specimens should look like from the western portion of the range, a light gray background color with narrow black bands that contain little orange. Picture 2 is a similarly patterned animal from the Hueco Mountains in Texas, collected by Danny Lemon. Some specimens may contain a considerable amount of orange in a similar pattern, such as the animal in picture 3, which is either UTEP 874 or 9404, collected by Alec Knight. These pattern types are normal southeastward through the Davis and Eagle Mountains in Texas and along the Rio Grande River Road, where darker animals also become common, such as the one in Picture 4, which is a captive bred individual from river road parents. Eastward to about Sanderson in Terrell County, most specimens are either a light or dark gray with or without orange in the narrow black bands.

Near Sanderson, and from there eastward, the Blair's phase becomes increasingly more common, with wide orange bands on either a light or dark gray background.

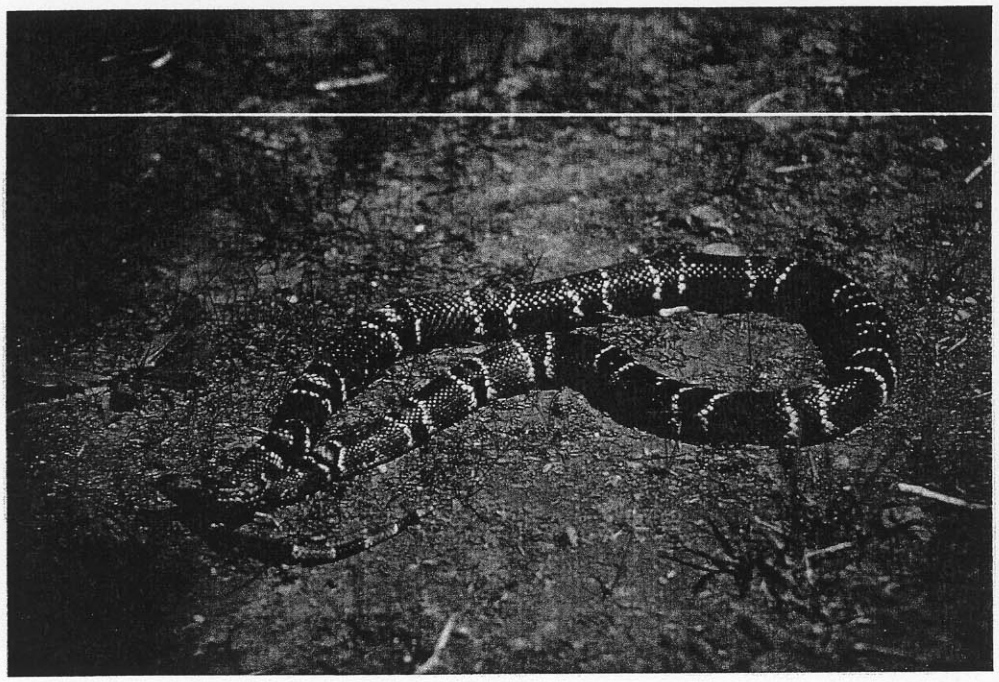


Picture 2. Lampropeltis alterna from the Hueco Mountains, El Paso County, Texas.

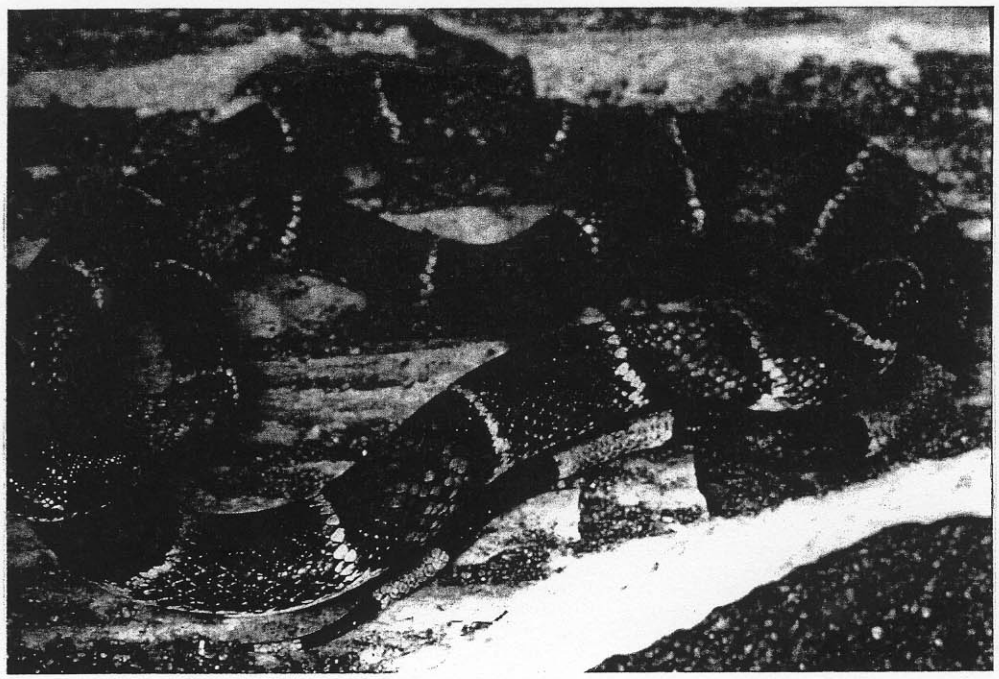


Picture 3. Lampropeltis alterna from the Hueco Mountains, El Paso County, Texas.

Picture 5 shows a dark Blair's phase animal from Langtry, while Picture 6 shows a light Blair's phase animal captive bred from Comstock area descendants by the author. However, the alterna phase animals with narrow bands are still found throughout the eastward portion of the species' range in Texas.



Picture 4. Captive bred Lampropeltis alterna from River Road parents, Presidio County, Texas. This is a dark alterna-phase animal.



Picture 5. Lampropeltis alterna from Langtry, Val Verde County, Texas. This is a dark Blair's phase animal.

Picture 6. Captive bred Lampropeltis alterna from Comstock area parents, Val Verde County, Texas. This is a light Blair's phase animal.

I have also talked to biologists and scientists who believe they have seen gray-banded kingsnakes in the wild in New Mexico, or animals that have come from New Mexico. These animals were all reported from within the area shown on map 3 as potential habitat within New Mexico, and there are six reports:

1. Mike Williamson (1993) of Albuquerque reported some people had visited him after a trip to the Big Bend region in the late 1970s. They told him that they had a gray-banded kingsnake that had been caught in the vicinity of Lechuguilla Cave in the Guadalupe Mountains of New Mexico. Mike showed me a slide of the animal, which was very similar to the one shown in picture 5. Since the animal does not look like specimens found in the western portion of the species' range, the species was protected in Texas at the time of capture (which would make an unlicensed collector likely to make a story that might explain how the animal could have been obtained legally), and Lechuguilla Cave was not discovered until 1986, I give this report no validity.

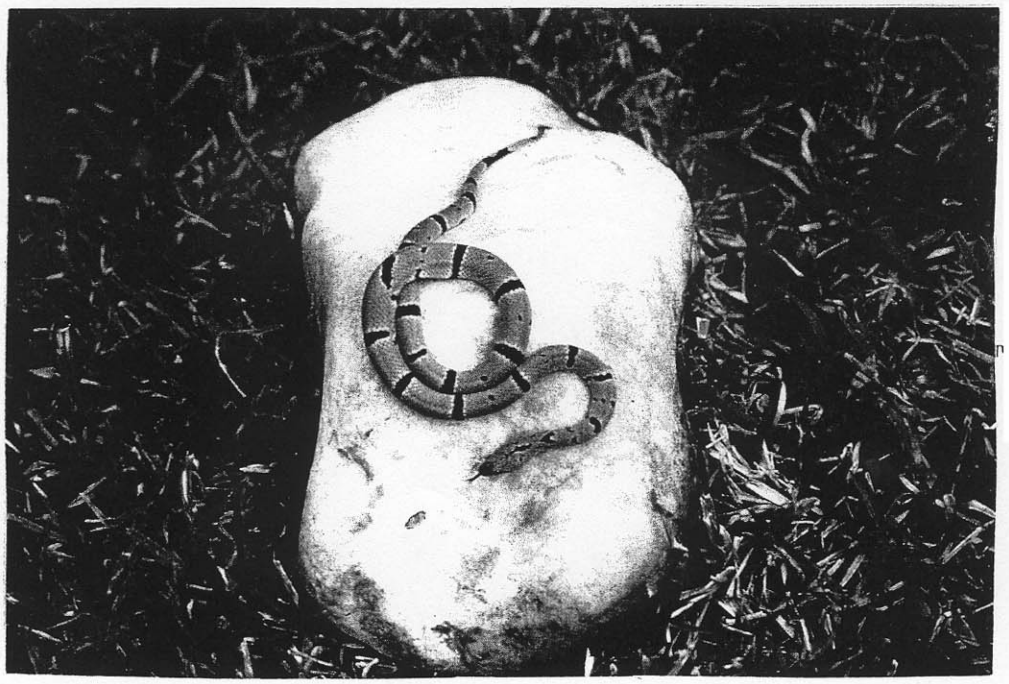
2. A teenage member of the New Mexico Herpetological Society from Albuquerque claimed to have found a light alterna phase animal crawling across the parking lot at Carlsbad Caverns in the mid 1980's. Although I have not seen the animal or talked with the person who claimed to have found it, I have no reason to doubt this claim. Since this is basically the same locality as Swinford's specimen, it is reasonable to believe that gray-banded kingsnakes occur at Carlsbad Caverns and throughout the limestone hills of the National Park.

3. Rick Smartt (1982) of the University of Texas El Paso reported that a student of his working on biological inventory for the Bureau of Land Management's McGregor Range Environmental Impact Statement had reported seeing a gray-banded

kingsnake in the limestone hills of northern McGregor Range in 1981. Since the animal was not collected, I am somewhat dubious of this report although the area falls into the potential habitat shown in map 3. The specimen was reportedly active in the daytime, which would be unusual but not unheard of for this species. There are other gray and black snakes (and some with orange) in the area including Hypsiglena torquata, Rhinocheilus lecontei, and Salvadora grahamiae. There is simply no way to be sure of this report without a specimen or a photograph.

4. John Sherman (1993), Wildlife Biologist for the Bureau of Land Management in Carlsbad, New Mexico, reported seeing a gray-banded kingsnake near Three Forks on the east side of the Guadalupe Mountains. He described the animal clearly as being light gray with black-edged orange bands. This area also falls into the potential habitat from map 3, and I believe that John very well could have seen a gray-banded kingsnake there, but without a specimen or a photograph it is impossible to verify.

5. Mark Heinrich (1993), a Veterinarian from Carlsbad who is an amateur snake collector, along with a friend from Georgia, reportedly found a gray-banded kingsnake at El Paso Gap in the Guadalupe Mountains in 1992. When I talked to Mark about it, he said that it was not at El Paso Gap but instead was found while he was lost in the middle of the night on dirt roads while trying to get from El Paso Gap to the Hueco Mountains. I have traveled all the roads in the area, and if he was indeed on a dirt road in limestone hills between El Paso Gap and the Hueco Mountains, he would have been in either Boardwell Canyon or southern Cornucopia Draw, or the Cornudas Mountains. All of these areas are within the potential habitat area of map 3 in Otero County. Picture 7 shows the specimen, which looks very similar to Swinford's specimen and to the Hueco Mountains specimens. I believe this animal was indeed found in Otero County, New Mexico.



Picture 7. Lampropeltis alterna believed to be from Otero County, New Mexico, collected by Mark Heinrich in 1992.

6. Mark Heinrich and his friend from Georgia reportedly found a gray-banded kingsnake in Carlsbad caverns National Park in 1994. I originally heard about this animal from one of the "locality specialists" in Texas who said he had been told of the find by the fellow from Georgia, who I do not know. I called Mark Heinrich about it, and he said that the animal had come from a "secret location" in Texas. I believe that this animal probably was caught in New Mexico, since that is the first story I heard, and because the person in possession of the animal is claiming it to be a New Mexico animal (although it is all hearsay).

I have heard rumors that gray-banded kingsnakes have been caught on the Sitting Bull Falls road in the Guadalupe Mountains, but have never heard by whom or when such specimens were supposedly taken. This area also falls into the potential habitat on map 3.

Field Sampling

I took six trips to Otero and Eddy Counties between August 1993 and September 1994 searching for Lampropeltis alterna. I did not find any gray-banded kingsnakes. I did not collect any specimens of any type on these trips.

Although I was unsuccessful at finding this species in New Mexico, I have spent a considerable amount of time looking at their habitat both in New mexico and in Texas. I have examined localities of specimens in Texas and followed the contiguous habitat up into New Mexico. Obviously, without collecting any additional specimens in new localities it is just conjecture that they may occur at other sites in New Mexico outside of the one confirmed location in Carlsbad Caverns National Park. Humans often do a poor job of trying to look at the world through an animal's eyes, but I think that the map I have produced should fairly well delineate the potential habitat of this species in New Mexico.

CONCLUSIONS

Lampropeltis alterna is known to occur from sparse records throughout much of West Texas and into New Mexico. There is one scientific record form Carlsbad Caverns National Park, and at least one more believable record from Otero County, New Mexico. These animals are abundant in the Langtry area of Texas, which receives intense pressure from private collectors. The plethora of gray-banded kingsnakes in Val Verde and Terrell counties in Texas is one of the best possible insurance policies for the species in New Mexico, because private and scientific collectors who really want to find one of these animals in the wild will likely go to this area, where they may easily find one or more specimens in a night, instead of places like the hills of southern New Mexico where it might take years of effort to produce a single specimen. It would be beneficial to the species throughout the remainder of it's range to allow continued collecting in the area of greatest abundance.

Private breeders are continuing to make gray-banded kingsnakes available to people who really want them without removing animals from the wild (although the breeding stock had to have come from the wild at some time). The Texas Department of Parks and Wildlife and New Mexico Department of Game and Fish should work to insure the availability of captive-bred specimens to reduce demands on wild populations throughout the species' range.

Because of the low humidity and remote, inaccessible nature of the steep to

precipitous rock outcrops in which these animals occur, and the radical temperature fluctuations in these desert mountains, it is likely that gray-banded kingsnakes spend very little time active above ground. In most of the potential habitat in New Mexico, the hills are characterized by deeply fissured limestone and huge boulders that would allow a small reptile to move through entire mountains without ever having to travel above ground.

The Texas banded gecko occurs sympatrically with the gray-banded kingsnake, but is also found in habitat types that are outside of the steep to precipitous hills favored by the kingsnakes. The Texas banded gecko does seem to hold promise as a potential indicator of the gray-banded kingsnake in steep to precipitous rocky terrain. A multiple regression analysis could probably provide a good predictive model of gray-banded kingsnake habitat when combined with other habitat parameters such as slope, soil type, and elevation. Soil surveys have not been completed for most of the West Texas counties where gray-banded kingsnakes occur.

Gray banded kingsnakes could be expected to occur throughout the limestone broken rock-Lozier association in Otero, Eddy, southwestern Chavez counties in New Mexico. Most of this habitat is inaccessible except by foot. A significant amount of this habitat is also protected from destructive human practices. Almost the entire Hueco Mountains in New Mexico are on McGregor Range, an expansion are of Fort Bliss. While this area may be subject to occasional shrapnel falling from missile firings, it is not grazed by domestic livestock, which should help to maintain natural vegetative cover, soil temperature and humidity regimes, and prey populations. Carlsbad Caverns National Park achieves the same benefits from excluding livestock grazing, although the road from the cavern to White's City must account for some roadkill and illegal collecting losses of gray-banded kingsnakes. Increased awareness and law enforcement presence by National Park Service staff could help reduce these risks.

The Guadalupe and Sacramento escarpments provide significant potential habitat for gray-banded kingsnakes that is too steep for much use by domestic livestock. These areas are also so extremely precipitous as to deter all but the most hardy humans even during the daytime. Very few people have probably ever been in these areas overnight. The remainder of potential habitat in New Mexico is altered by human activities including cattle and sheep grazing, which could have significant adverse impacts on soil temperature and humidity and prey populations.

I had hoped to conduct additional research on gray-banded kingsnakes using ovulating captive females as lures in traps, and attempting to catch males, which would have the minimal impact on the wild population. However, discussions with Adams and Jacobson (1994) have led me to believe that such an action, while potentially an easy way to ascertain additional populations in New Mexico, could have severe consequences to wild populations by risking transmission of diseases from captive to wild animals. It is thought that such an exposure of captive to wild reptile populations is responsible for the bacteriophage epizootic affecting desert tortoise populations. I am unsure of the morality of this approach to science when the potential risks are considered.

LITERATURE CITED

Flury, A. 1950. A new kingsnake from Trans-Pecos Texas. Copeia 1950:215-217.

Garstka, W.R. 1982. Systematics of the mexicana group of the colubrid genus Lampropeltis, with an hypothesis mimicry. Harvard University Museum of Comparative Zoology. Breviora 466.

Gehlbach, F.R., and G.E. Baker. 1962. Kingsnakes allied with Lampropeltis mexicana: Taxonomy and Natural History. Copeia 1962(2):291-300.

Gehlbach, F.R., and C McCoy. 1965. Additional observations on variation and distribution of the gray-banded kingsnake, L. mexicana (Garman). Herpetologica, 21(1):35-38.

Heinrich, M. 1993. Personal communication.

Hyder, P. 1993. Personal communication.

Mecham, J.S., and W.W. Milstead. 1949. Lampropeltis alterna from Pecos County, Texas. Herpetologica 5:140.

Miller, D. 1979. A life history study of the gray-banded kingsnake, Lampropeltis mexicana alterna in Texas. Master's thesis, Sul Ross State University.

Painter, C. W. 1994. Personal communication.

Sherman, J. 1993. Personal communication.

Smartt, R. 1982. Personal communication.

Swinford, G. 1991. Personal communication.

Williamson, M. 1993. Personal communication.

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