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Notes on Mexican Herpetofauna 9: Herpetofauna of a Fragmented *Juniperus* Forest in the State Natural Protected Area of San Juan y Puentes, Aramberri, Nuevo León, Mexico

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Abstract

The herpetological diversity of the *Juniperus* forest of the State Natural Protected Area San Juan y Puentes, Aramberri, Nuevo León, Mexico, was studied, based on field work and literature records. This small protected area mostly consisted of three plant communities: *Juniperus*, *Juniperus*-mezquital halophytic forest, and microphyll desert scrub; all were considered for sampling. The herpetofauna observed in the field consisted of 2 species of amphibians, 6 of lizards and 9 of snakes (7 colubrids and 2 viperids). Together with species reported in the literature a total of 45 species are found here, representing 31.7% of the herpetofauna of the state. The fragmentation of the habitat and the surrounding plant communities show a greater diversity than *Juniperus* forest in other similar areas in North America. This ecosystem is now being heavily fragmented.

Keywords: Herpetofauna, *Juniperus* Forest, Nuevo León, Mexico

Introduction

The San Juan and Puentes State Natural Protected Area is in the municipality of Aramberri in the southwest portion of the state of Nuevo León, Mexico (Figure 1). The original vegetation community was *Juniperus*. The present extent of the forest is 132.36 ha; nevertheless, the protected area is only 21.66 ha. Forty years back this area also included a fossil lake system (Bolson de Sandia = Pluvial Lake Sandia) of underground streams and springs of different sizes and characteristics. What was once a beautiful oasis in the heart of the desert area of Nuevo León is now completely dry, and in need of restoration and conservation. This ecosystem was probably very similar to areas such as La Media Luna in the Mexican state of San Luis Potosí and Cuatro Cienegas in Coahuila.

This vegetation community dominated by *Juniperus* was very extensive. It was composed of the one-seed juniper, *Juniperus monosperma*, and the alligator juniper, *Juniperus depeana*, all of great size and exceptionally old. This enclave in the physiographical region known as the *Altiplano Mexicano* is now dying.

In the ancient springs fish could be found. All of these species were considered micro-endemic, due to the fact that each spring possesses its own physical-chemical characteristics. Twenty years back a few still-existing springs harbored a small number of *Cyprinodon* species such as *C. longidorsalis, C. inmemoriam, C. veronicae* and *C. ceciliae.* These were described and identified, all new to ichthyologists, but are now extinct (Lozano-Vilano and Contreras-Balderas, 1993; Contreras-Balderas and Lozano-Vilano, 1993).

Significantly, local inhabitants of the region talked about the existence in these springs of large fish that were captured for food; they also spoke of the presence of many different water and land invertebrates, turtles, toads, frogs, snakes and a huge number of migrating aquatic birds.

Considering the extinction of the micro-endemic fish, it is reasonable to assume that the amphibian and reptile groups suffered the same fortune. Unfortunately, the indiscriminate use of the water system for inadequate agriculture methods forced locals to seek underground aquifers. This practice accelerated the drying of the springs and the disappearance of

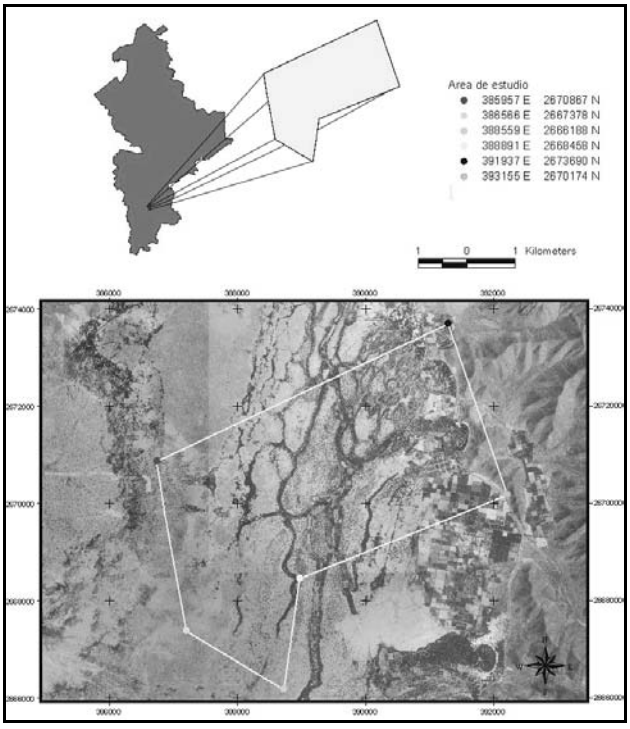

Figure 1. Aerial map of the study area, with a diagram showing its location in the state of Nuevo León, Mexico.

Table 1. Herpetofauna reported for the State Natural Protected Area of San Juan y Puentes, Aramberri, Nuevo León, Mexico, and its status in the Norma Oficial Mexicana (059-2001): A = amenazada (threatened); E = endémica (endemic); Pr = protección especial (special protection); SE = sin estatus (without status). Scientific names follow Crother et al. (2003), Flores-Villela and Canseco-Márquez (2004) and Frost et al. (2006).

Group	Family	Species	Status
Anura	Bufonidae	*Anaxyrus cognatus**	SE
		*Anaxyrus punctatus**+	
		*Chaunus marinus**	SE
		*Cranopsis nebulifer**	SE
	Leptodactylidae	*Eleutherodactylus augusti augusti**	SE
	Microhylidae	*Gastrophryne olivacea**	Pr
		*Hypopachus variolosus**	SE
	Scaphiopodidae	*Scaphiopus couchii**+	SE
		*Spea multiplicata multiplicata**	SE
	Rhinophrynidae	*Rhinophrynus dorsalis**	Pr
Squamata: Sauria	Phrynosomatidae	*Cophosaurus texanus scitulus**+	A
		Holbrookia approximans+	SE
		*Phrynosoma cornutum**	A
		*Phrynosoma modestum**	SE
		*Sceloporus cyanogenys**	SE
		*Sceloporus grammicus disparilis**+	Pr
		*Sceloporus marmoratus**	SE
		*Sceloporus olivaceus**+	SE
		*Sceloporus spinosus spinosus**	SE
	Teiidae	*Aspidoscelis gularis gularis**+	SE
		*Aspidoscelis tigris**+	SE
Squamata: Serpentes	Colubridae	*Arizona elegans elegans**	SE
		*Diadophis punctatus regalis**	SE
		*Drymarchon melanurus erebennus**	SE
		*Heterodon kennerlyi**	Pr
		*Hypsiglena torquata jani**	Pr
		*Lampropeltis getula splendida**	A
		*Lampropeltis mexicana**	A-E
		*Leptodeira septentrionalis septentrionalis**	SE
		*Masticophis flagellum testaceus**+	A
		Masticophis schotti ruthveni+	
		*Pantherophis emoryi**+	SE
		*Pituophis deppei jani**+	A-E
		*Rhinocheilus lecontei tessellatus**	SE
		*Salavadora grahamiae lineata**+	SE
		*Storeria hidalgoensis**	SE
		*Tantilla atriceps**	A
		*Tantilla rubra**+	SE
		*Tantilla wilcoxi**+	SE
	Elapidae	*Micrurus tener tener**	Pr
	Leptotyphlopidae	*Leptotyphlops myopicus**	SE
	Viperidae	*Crotalus atrox**+	Pr
		Crotalus molossus nigrescens+	Pr
		*Crotalus scutulatus scutulatus**	Pr
Testudines	Kinosternidae	*Kinosternon integrum**	SE

* Species reported by Anonymous (2000) + Species observed during this study

Table 2. Species observed and their plant community associations in the State Natural Protected Area San Juan y Puentes, Aramberri, Nuevo León.

Group	Family	Species	*Juniperus*	*Juniperus*–Mezquital	Microphyll Desert Scrub
Anura	Bufonidae	*Anaxyrus punctatus*		X	
	Scaphiopodidae	*Scaphiopus couchii*	X		
Squamata: Sauria	Phrynosomatidae	*Cophosaurus texanus scitulus*		X	X
		Holbrookia approximans		X	X
		Sceloporus grammicus disparilis	X		
		Sceloporus olivaceus	X		
	Teiidae	*Aspidoscelis gularis gularis*		X	X
		Aspidoscelis tigris		X	X
Squamata: Serpentes	Colubridae	*Masticophis flagellum testaceus*		X	
		Masticophis schotti ruthveni		X	
		Pantherophis emoryi	X		
		Pituophis deppei jani	X		
		Salvadora grahamiae lineata	X		
		Tantilla rubra	X	X	
		Tantilla wilcoxi	X	X	
	Viperidae	*Crotalus atrox*	X		X
		Crotalus molossus nigrescens	X		X

all their residents, many of which were never known to biologists, causing great damage to the scientific patrimony of the state and country.

To add to these problems, immoderate logging of the *Juniperus* has strongly fragmented the forest. In recent studies of the vertebrate fauna, we have encountered populations that suggest the possible presence of undescribed subspecies that have adapted to the area for millions of years. These populations are seriously threatened with extinction as the forest is little by little consumed or dying because of changing environmental conditions (soil moisture content).

It is important to call the attention of all levels of authority, associations, and organizations to supporting research projects that will increase our knowledge of the biological diversity that has survived the impact of anthropogenic development, and if possible establish a much larger protected area as a biological corridor that will guarantee the survival of these populations throughout their range. The local human population is less than a thousand inhabitants. Strange to say, their agriculture and small grazing area still cannot sustain them. Yet they have destroyed an ecosystem of incalculable biological richness.

Canseco-Márquez et al. (2004), analyzed the distribution of the herpetofauna throughout the Sierra Madre Oriental complex and reported 207 species present for this mountain chain. Of these, 10.6% were found in the *Juniperus* forest and tropical deciduous forest. In particular for the *Juniperus* forest in Nuevo León, there is little information on the faunistic communities. Such information is crucial and important to determine, as this can be an important factor that can contribute to or support criteria for the future conservation of this ecosystem.

Methodology

The area is located between 1560 and 1600 m elev. (Figure 1); it consists of a large plain, found along the Sierra Madre Oriental. The vegetation communities reported for this physiographic province that also belong to the natural protected area are the following: *Juniperus*–mezquital forest, *Juniperus*–mezquital halophytic forest, submontane scrub forest, rosetophilic desert scrub, scrub–pine, microphyll desert scub, halophytic vegetation and halophytic grassland. Of these plant communities only *Juniperus*, *Juniperus*–mezquital halophilic and microphyll desert scrub were herpetologically sampled. The dominant *Juniperus* forest is composed mainly of one-seed juniper (*Juniperus monosperma* var. *gracilis*) and alligator juniper *(Juniperus depeanna),* mesquite (*Prosopis glandulosa*), tree cholla (*Opuntia imbricata*), desert Christmas cactus (*Cylindropuntia leptocaulis*), grama (*Bouteloua chasei*, *B. barbata*), tubercled saltbush (*Atriplex acanthocarpa*), Mexican seepweed (*Suaeda mexicana*), slimflower muhly (*Muhlenbergia monticola*), and garbancillo (*Peganum mexicanum*). Surrounding this *Juniperus* forest, we encounter a *Juniperus*–mezquital halophilic forest community; this community is composed of mesquite, tree cholla and Berlandier's wolfberry (*Lycium berlandieri*). The microphyll desert scrub is dominated by creosote bush (*Larrea tridentata*), Texas goatbush (*Castela texana*), tree yucca (*Yucca filifera*) and crown of thorns (*Koeberlinia spinosa*).

Sampling areas were established according to the natural protected area program (Anonymous, 2000) and its management plan (AMAVISI, 2002). Because of the small size of the protected area, only *Juniperus*, *Juniperus*–mezquital halophilic forest, and microphyll desert scrub were considered for sampling. A total of ten field trips were conducted (one per month) with a duration of 3 days each. In each of the three plant communities extensive searching was done. Collecting and observations took place during daylight hours (0900–1700 h) under various weather conditions. Pitfall traps were impractical due the presence of a very compact soil that made it almost impossible to dig to introduce the plastic buckets. All

amphibians and reptiles observed were either identified using Conant and Collins (1998), Smith and Taylor (1966) and accounts from the Catalogue of American Amphibians and Reptiles published by the Society for the Study of Amphibians and Reptiles, or were documented by a photograph. A few specimens were collected as vouchers and deposited in the herpetological collection of the Facultad de Ciencias Biológicas of Universidad Autónoma de Nuevo León.

Results and Discussion

Based on Contreras-Arquieta and Lazcano (1995) and Lazcano and Contreras-Arquieta (1995), Nuevo León harbors 142 species of amphibians and reptiles, from which AMAVISI (2002) reported 49 species for the State Natural Protected Area of San Juan y Puentes. In this study we observed 2 amphibians, 6 lizards and 9 snakes (7 colubrines and 2 viperines) of which *Holbrookia approximans* and *Crotalus molossus nigrescens* are new reports for the area. Between our field work and an intensive literature search the total number of species for the area now stands at 45 species (Table 1). We do not doubt that this list could contain more species than we are reporting here. More searching time will be needed and in all weather conditions to obtain an accurate list of the herpetological population here. Eddleman et al. (1994) mention that the amphibian and reptile fauna from a *Juniperus* forest in the northeastern United States comprised 15 species. Miller (2001) pointed out the herpetological diversity in a *Juniperus* forest in the western United States was a little higher — 15 species of reptiles and 2 of amphibians. In this study we observed 15 reptile species and 2 amphibian species in the *Juniperus* forest of Aramberri. Adding those cited in Anonymous (2000) we have 35 species of reptiles and 10 of amphibians, making the total 45 species. Clearly, this diversity exceeds that of the areas studied by Miller (2001) and Eddleman (1994).

We should not forget that this forest is greatly fragmented and ecologically disturbed. The high number of species could be an artifact of its fragmentation, and subsequent recolonization by species that need open areas for thermoregulation. A high degree of fragmentation and ecologically disturbed habitat could tend to increase species richness and abundances of those species that require such areas. The following authors have written extensively about fragmentation and its effects on various animal communities: Addicott, 1978; Harrison et al., 1988; Henderson et al., 1985; Jones, 1988; Merriam and Wegner, 1992; Norton et al., 1995; Paine, 1988; Turner and Gardner, 1991; Villard et al., 1992; Wegner and Merriam, 1990; With and Crist, 1995.

Within Nuevo León's State Natural Protected Areas, there are areas of similar or even higher diversity, where the dominant vegetation is pine–oak. Such an area is the Parque Ecológico Chipinque in Garza García, Nuevo León, where we registered a diversity of 38 reptile species and 7 amphibian species (Banda-Leal, 2002; Lazcano et al., 2006). Another example is an area known as La Trinidad, with a microphyll desert scrub plant community, home to approximately 39 reptiles and 5 amphibians. Sierra San Antonio Peña Nevada, with various plant communities, harbors 32 species of reptiles and amphibians (Lazcano et al., 2004). Finally it is important to mention that within this area of the *Juniperus* forest of Aramberri there are seven species considered threatened, two endangered and nine in special protection. That it is why it is very important to urge conservation of the area to benefit the herpetofauna and other vertebrate groups.

It is essential to mention that even though we didn't determine or measure the extent of the *Juniperus* forest fragmentation, if this continues at its present rate, the forest will give way to drier plant communities, with unknown consequences to the present herpetofauna, or to open spaces favoring the more heliothermic species (most of the phrynosomatid species) (AMAVISI, 2002).

Yet another severe problem has been plaguing the area with increasing frequency. When the springs were functional their water cycle permitted the sedimentation of organic material. As they dried, these sediments became prone to combustion and have been burning since, suffocating the remaining root systems of the few *Juniperus* trees that are still alive.

Table 2 shows the species found and their plant associations. Most of the lizard species require open areas for diurnal activities, except for species like *Sceloporus grammicus disparilis* and *Sceloporus olivaceus* that were always associated with *Juniperus* areas. Snakes were always found near *Juniperus* or cholla tree (*Opuntia imbricata)* refuges. Because the lizard community here is very active during sunny days in this fragmentized *Juniperus* forest a parallel study was conducted, where we determined the thermal and spatial niche overlap. Similar studies on other vertebrate groups took place during the conduct of this study; Valero (2004) worked with mammals and Ballesteros (2004) with birds.

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A Note on Cannibalism in the Common Garter Snake, *Thamnophis sirtalis sirtalis*

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Mitchell (1986) provided a thorough review of cannibalism in reptiles, and cited four instances in *Thamnophis sirtalis*. Cannibalism in this species has been noted both in the field and in captivity (Schwartz, 1985; Mitchell, 1986). Here I report on an instance of attempted cannibalism in captive *T. sirtalis*.

On 19 January 2001 at 0845 h, I discovered one of my male *Thamnophis sirtalis* (485 mm total length [TL]) attempting to consume its larger (550 mm TL) sibling, head first (Figure 1). The two snakes involved had been cage mates since their birth in 1997 to a female that had been collected from a hazardous waste area, and subsequently produced both merolepid and normal individuals (Gray et al., 2001). The two snakes were maintained together in a 10-gallon aquarium with pine shavings as a substrate; a water bowl and an under-tank heater were also provided.

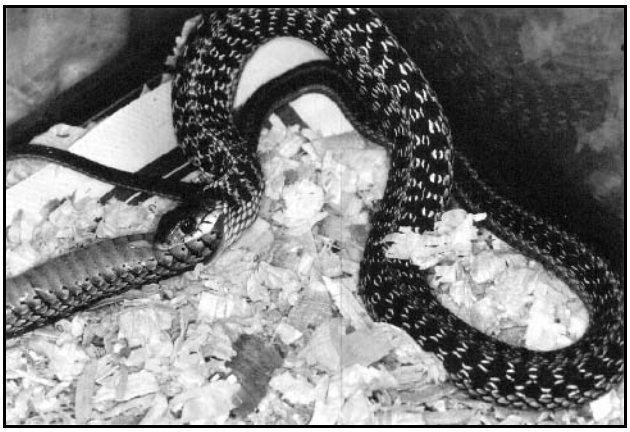

Figure 1. Male *Thamnophis s. sirtalis* attempting to consume its larger sibling.

At the moment of discovery, the smaller snake had swallowed about half of the larger individual. My initial response was to try and save the larger snake; however, I soon realized that the individual was dead.

At 0900 h, approximately 15 minutes after the initial discovery, the smaller snake disgorged the larger individual, which had been two-thirds ingested. At that time I removed the dead snake from the enclosure, and placed it in 70% isopropyl alcohol, and later sent to Hobart Smith. At 0910 h the smaller individual was observed tongue-flicking the area where it had disgorged its sibling. This species may accidentally cannibalize cage mates during feeding episodes, when two individuals attempt to consume the same food item. The present observation is significant because it did not occur during a feeding episode. The last feeding, consisting of night crawlers (*Lumbricus terrestris*), had been six days prior. Therefore, it is most likely that this attempted act of cannibalism resulted from active pursuit/predation as described by Schwartz (1985).

Based on this observation, as well as those cited in Mitchell (1986) it may be wise to keep individuals of this species housed separately, except during breeding attempts.

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