

A Collection of Communications

from

Eric M. Rundquist

in

Reference to the Herpetofauna

of the

Alexander Ranch,

Barber County, Kansas,

1991 -2002

and

Including a Summary of Observations

on the

“Nightsnake”,

Hypsiglena torquata

18 July 1991

Ted Alexander
Alexander Ranch
Sun City, Kansas

Mr. Alexander:

Sorry I missed you last weekend but I thought I'd drop you line to let you know how our excursion went last week. We did manage to find the bridge and cave. I see the old fence line has been replaced and that threw me for a bit but we did eventually find the new path to the south. As I told you, I was interested in seeing whether a certain type of bat still occurred at the cave and was very pleased to find a few at the site that night. This bat is called the pallid bat (*Antrozous pallidus*) and as far as I know the natural bridge cave is the only known site in the state where this species occurs. Back in the late 60s we trapped well over 100 specimens there one night. Although we only saw three last week, it was relatively early in the evening and I am fairly sure the main group doesn't arrive until well after midnight. I hope to come back sometime in the next few weeks at a later time and establish whether or not the same numbers still use this cave as a night roost. The cave itself seems to be rather filled in from what I remember but there still appears to be sufficient room for this species to use it as a roost site.

Although I am sure you are aware of some of the unique features of Bear Creek cañon, you may not be aware of some of its biological uniqueness. Several species of threatened and/or endangered species have been found there in the past. These include the red-spotted toad (*Bufo punctatus*), the southern prairie skink (*Eumeces septentrionalis obtusirostris*), the Texas blind snake (*Leptotyphlops dulcis dissectus*), the Texas longnose snake (*Rhinocheilus t. tessellatus*), and the Texas night snake (*Hypsiglena torquatus jani*). In addition, although not officially listed as threatened or endangered, the Mexican freetailed bat (*Tadarida mexicana*) has also been found here, only the second known locality in Kansas. As far as I know, except for one site in southeastern Kansas, your property has the highest per capita concentration of threatened/endangered species of any place in the state. From my preliminary observations, the land appears to be in excellent condition and there does not seem to be any sort of environmental degradation. I wish other landholders in Kansas had the same sort of regard for their land as you folks do in the Gyp Hills.

On a more personal note, I saw that Alma Hathaway passed away recently. I had heard that she had been quite ill and was sorry to learn of her death. I don't know if you know Buster but if you do and should you run into him, I would appreciate it if you could pass along my condolences. I'm sure he doesn't remember me and it has been many, many years since I enjoyed a Hathaway schooner and cheeseburger, but he may remember in the summer of 1969 a crew of crazy bat chasers from the University of Kansas that occasionally partook of their hospitality.

Hope things are going well. I'll keep in touch.

Best,

A handwritten signature in cursive script, appearing to read "Eric".

Eric M Rundquist

12/85/99
Eric M Rundquist

**Yearly Totals of Reptiles Observed at 3 Study Areas
on the Alexander Ranch, Barber County, Kansas**

1997

1 Ornate Box Turtle
3 New Mexico Blind Snake °
1 Glossy Snake °
1 Great Plains Rat Snake
1 Eastern Hognose Snake
2 Night Snake °
2 Coachwhip
5 Lined Snake
3 Ground Snake
6 Collared Lizard
1 Texas Horned lizard
1 Prairie Lizard
3 Great Plains Skink
1 Ground Skink
1 Prairie Rattlesnake

1998

4 Ringneck Snake
1 Great Plains Rat Snake
1 Brown Snake
3 Plains Blackhead Snake
10 Lined Snake
16 Collared Lizard
1 Texas Horned Lizard
6 Prairie Lizard
5 Great Plains Skink
1 Ground Skink
3 Prairie Racerunner

1999

1 New Mexico Blind Snake °
1 Racer
3 Ringneck Snake
3 Great Plains Rat Snake
1 Night Snake °
1 Common Kingsnake
1 Coachwhip
1 Bullsnake
2 Plains Blackhead Snake
1 Garter Snake
6 Lined Snake
6 Collared Lizard
1 Texas Horned Lizard
6 Prairie Lizard

- 3 Great Plains Skink
- 1 Southern Prairie Skink °
- 3 Ground Skink

° - Species listed as protected under state law

QUICK ANALYSIS

A total of 24 species of reptiles have been documented from 1997-99. Of these, only one species is a turtle, which is expected. The most common species are the Collared Lizard, Prairie Lizard, Great Plains Skink, Lined Snake, and Great Plains Ratsnake. Of the protected species, all populations appear to be stable at this time and a breeding population of the very rare New Mexico Blind Snake has been documented. The Prairie Rattlesnake has had a lower than expected documentation and the local population of this species appears to be serious decline. The Texas Horned Lizard, which has suffered serious population declines in Oklahoma and Texas, appears to be stable on the ranch.

I have not listed amphibian species numbers at this time because I have not done enough work as yet to establish any firm numbers. However, I can say that the rare Red-spotted Toad is widespread on the ranch and numbers appear stable. All other species observed appear to be stable at this time. However, other expected toad species have not been observed. This is most likely an artifact of timing, as proper breeding conditions for these species have not been present when I have been onsite.

ALEXANDER PROJECT 2001

Ted,

Here's my report for results of my field studies on your ranch in 2001.

The survey period occurred from May through October. Normally, activity would have begun in April but this was not possible in 2001.

Amphibian numbers were up compared to 2000. This is primarily because of the discovery of significant breeding populations of the spotted chorus frog on the ranch's eastern section. The primary breeding site was a relatively large pool northeast of the sand pit. Other potential breeding sites (sinks and wallows) were not as productive but I did note a plant association that may be a key indicator of amphibian pond use. I plan to follow that up in 2002.

Additionally, one new amphibian species was observed in 2001. This was the plains spadefoot, a frog that is abundant in the Gyp Hills but which I had not observed on your place before, although I have expected to find it.

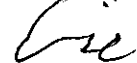
I still continue to be a little puzzled by the lack of breeding populations of toads. I was unable to locate any breeding sites for the red-spotted toad, even though an evening was spent searching in June at peak conditions. I continue to find adults throughout your west and east sections and have no doubt that breeding sites will eventually be found. I did not find breeding sites for Woodhouse's and Great Plains toads again. I have found individual Woodhouse's toads in the past.

Overall reptile numbers were approximately the same as for 2000 but there were some significant differences. Collared lizard numbers were significantly down from the previous year, both for adults and juveniles. This is probably a normal population fluctuation or may be a result of winter kill. Six-lined racerunner numbers were significantly up but this is a result of greater pit trapping success than in the past. Aquatic turtle numbers (red-eared slider and spiny softshell) were 50% fewer than last year. This is directly attributable to winter kill from the harsh winter of 2000-2001. As there were only two spiny softshells on your property and the one missing this year was an adult male, it is likely that this small population will be extirpated in coming years. Finally, I did not capture any Great Plains rat snakes this year. I do not know whether this absence is real or a result of me being in the wrong place at the wrong time. I suspect it is real and related to winter kill again.

In addition, I observed five new species on your property this year. These are: yellow mud turtle, common snapping turtle, western slender glass lizard, racer (snake), and northern water snake. The discovery of the mud turtle was a bit of a surprise as I normally associate this species with lowland habitat east of your place. The sand pit and pool northeast of the sand pit are where these turtles were seen (breeding I might add). The northern water snake sighting was also a little surprising, as the diamondback water snake and plainbelly water snake are much more common in the area.

In all, I have now documented 41 species of amphibians and reptiles on your property, making this land some of the most herpetologically diverse territory in Kansas.

Sincerely,



Eric M Rundquist
herpetologist
University of Kansas

ALEXANDER PROJECT 2002 REPORT

Ted,

Here's my report for results of my field studies on your ranch for 2002.

The survey period occurred from April through October.

Amphibian activity was limited by drought early in the survey period (April-July). However, heavy rains in August and September stimulated late breeding of considerable number of Plains spadefoots. Tadpoles were found at sinks to the north of your house and at sinks along the old Fort Zarah trace. These breedings are the latest ever recorded for Kansas and no doubt resulted from an inability to breed earlier due to the aforementioned drought. In addition, good numbers of young-of-the-year Plains leopard frogs were also found at these sites. These animals were obviously dispersing from earlier breedings at permanent water sites (breeding probably occurred in March-April). This is an interesting phenomenon in that these young animals are exposing themselves to considerable risk from desiccation and predators and, undoubtedly, large numbers do not survive. There must be a significant survival advantage to this behavior to take such risks and it would be interesting to have someone explore this behavior in depth. I suspect the dispersal is influenced by food and space limitations and competition from other leopard frogs. It may also ensure high genetic variability, which is an evolutionary hedge against extreme selective pressures.

The other amphibian find of interest was the discovery of an adult tiger salamander in Still Cave in August. Although this animal is relatively common in other cave systems in the area, I had not expected to find the species on your property because of the lack of interlocking cave systems. It will be interesting to see if there is a viable population at this cave site (which means having to go into that hole several times a year, dammit).

Overall, snake numbers were down for the year, with the exception of one species. Given the drought conditions and previous experience, I predicted this phenomenon. Virtually all rock-dwelling species had disappeared by the end of May. This is the third time I have witnessed this phenomenon and it may be an early predictor of at least short-term drought conditions. I don't have a way to quantify this yet but I will work on it further.

Rains in later summer-early fall had no effect on snake numbers, at least for small species. This indicates to me their yearly activity cycle may be dramatically affected by early season moisture availability. This, however, does not mean actual numbers were either increased, decreased, or remained the same. The animals probably remained in aestivation (similar to winter hibernation).

The one snake species whose numbers were up this year was the Nightsnake, with a total of five individuals discovered, including the first young-of-the-year hatchling I have found (east site). As a result of these specimens, and others I've found on your place over the years, I was able to publish a significant

paper on the natural history of this supposed "threatened" species (a copy of this publication is attached). I have recommended that the Kansas Department of Wildlife and Parks downlist this snake from "threatened" status to "species-in-need-of-conservation." This was a political decision on my part, because I don't think the powers that be would go for removing the species entirely from some sort of protection (which would be my preference). However, I think I did demonstrate that ranching activities such as yours may actually enhance the population status of such species and that is the sort of thing that these bureaucrats need to see. At any rate, it is the first major paper as a result of our collaboration and shows that this long-term approach yields significant results.

Lizard numbers, on the other hand, were way up. In fact, it was a banner year reproductively. This was probably a result of the relatively mild winter and the huge grasshopper hatch early in the season. Having this much food available allowed both adult males and females to pack on significant fat reserves and devote a great deal of their resources to reproduction, rather than survival. As a result, one species (prairie lizard) had at least two, and possibly three, reproductive events. Normal is one, with a second if everything goes just right. I also saw evidence that collared lizards may have laid two egg clutches. This has never been observed in the central Great Plains and really isn't well-established by research elsewhere.

For the most part, the lizard species that occur on your place are not as tied into water resources as much as the snake species are. Many lizards can get their water metabolically (from food). Others can secure water from such things as dew on plants (which snakes never do). So the drought had little, if any, effect on their survival, other than it promoted that enormous grasshopper hatch I mentioned.

I did note one interesting thing about the collared lizard population this year. Virtually all the specimens I found in September and October were hatchling, one-, or two-year old animals. The hatchlings I expected. I found very few one- and two-year olds earlier in the year, so my question is where were they earlier and where did they come from? None of the older animals were previously marked by me. This may be an indication of a pretty significant dispersal event but I need to go over the data more thoroughly and compare to previous data. At any rate, I thought it was a bit weird.

The only new reptile species found on your place this was a specimen of the common gartersnake. This animal was found dead on the Sun City Road right at your north property line. It was an expected species. The total number of amphibian and reptile species found on your place now comes to 43. This is 93% of the species I have expected to find on your property.

Date Julian Rotated OUT OF IN TO Rotated IN TO Rotated Grazed Rest/ Precip Precip Precip Precip SDA/ Total Last Year Present SD

AN EMERGING THREAT TO A FRAGILE KANSAS HERPETOFAUNA

In 1992, I began herpetological survey work on the Alexander Ranch in northwestern Barber County, Kansas. Initially, this work concentrated on informal surveys of amphibian and reptiles in connection with the KHS Spring Herp Counts. Beginning in 1996, I initiated more systematic studies of the natural history and population dynamics of the ranch's herpetofauna.

The Alexander Ranch is located due south of Sun City within the Gypsum Hills subprovince of the Red Hills Province in Kansas. It occupies approximately 10.5 sq. mi. (a little more than 7000 acres). The primary vegetation is sandsage prairie, although significant riparian habitat occurs on the eastern section of the ranch, with lesser amounts of riparian habitat on the western section. The southern ranch section is almost entirely sandsage prairie, with a smaller portion of former farmland that is being restored to grassland. The dominant rock formations on the eastern and western sections are gypsum and limestone, with significantly lesser formations of Dakota sandstone-like material. The only rock formations on the southern section are small outcrops of a sandstone-like marl. The ranch typically receives between 21-24 inches of moisture per year, although as little as 17 inches and as much as 27 inches have been recorded during my work here. Temperatures have ranged from -12°F to 115°F, which makes this area one of the most extreme temperature environments in the continental United States. The primary human-induced activity on the ranch is intensive grazing management for cattle, with an emphasis on management activities that retain grassland moisture,

My field year begins in March and concludes in October and consists of two- to three-day sampling periods per month at three primary sites on the ranch along with trail surveys and selected sampling of other ranch sites as time permits. All captured specimens of reptiles are measured, marked, and released at their capture sites. Amphibian taxa are generally only counted, although mark-recapture methods are instituted for one species. Survey methods consist of rock turning, visual and aural surveys, pit trapping, board trapping, road driving, and transect walking along trails.

To date, 40 species of amphibians and reptiles have been documented on the ranch. I expect to find at least another five species here. In other words, at least 40% and perhaps as much as 45% of the known Kansan herpetofauna occurs on this ranch, which constitutes less than 0.0001% (ten thousandth) of the total Kansas land area. Studies here have documented the following rare species: red-spotted toad, glossy snake, southern prairie

me that these conditions forced feral swine from past preferred habitat into previously unutilized areas in search of food, while remaining close to cover and abundant water.

So, what does this apparent behavioral shift mean to the current herpetofauna of the Alexander Ranch, and, more broadly, to the herpetofauna of the Gypsum Hills? I believe that there are a number of potential consequences, none of which are positive, at least as far the native herpetofauna is concerned. It is likely that pigs will continue to exploit and expand into upland habitats in which to forage, especially if the area experiences another harsh winter, which I believe is likely this year. Feral pigs have been well-documented as having devastating effects on certain herpetological communities in the United States, particularly amphibians and surface-active snakes. Pigs both destroy herp habitat and readily consume amphibians and reptiles. I believe that feral pigs in the Gypsum Hills present the latter threat most strongly. Such species as the red-spotted toad, ornate box turtle, yellow mud turtle, Texas horned lizard, southern prairie skink, any aquatic or semi-aquatic snake of the genera *Nerodia* and *Thamnophis*, coachwhip, common kingsnake, glossy snake, long-nose snake, night snake, Great Plains rat snake, bullsnake, massasauga, and western rattlesnake are the most vulnerable species in the area. Rock-dwelling species such as the blind snake and lined snake are probably too small and well-protected to be threatened at the present time. However, should these swine learn to root under rocks, and that is entirely possible, perhaps probable, then any amphibian or reptile with such preferred habitat is vulnerable. In addition, the single populations of red-eared slider and spiny softshell turtle on the ranch are vulnerable to nest raiding. Such populations on any of the permanent creeks, streams, or rivers in the area are also vulnerable.

Herp populations, particularly reptiles, on the Alexander Ranch are characteristically small, as one would expect in any desert grassland, which is essentially what this area is. Reproductive rates for all but a few species are low, with small clutch sizes and biennial reproduction appearing to be the norm for a number of reptile species here. Amphibian reproduction, except for riparian species such as *Rana* and *Acris*, is confined to a number of small sinks scattered throughout the ranch and only occurs under certain precise environmental conditions, none of which may occur in the proper order during any calendar year. Timing is everything in the desert, which makes any disruption of breeding activities particularly critical and presenting long-term population consequences.

So, what can be done to eliminate or reduce feral pigs in south-central Kansas? At this point, I believe it is impossible to eliminate these non-native invaders. Too much time has passed since the original introduction and too much cover and food exist in the area. The spread of the western red cedar throughout the area over the past 35 years provides ideal

skink, Arid Land ribbon snake and night snake. I have documented significant breeding populations of the Texas blind snake (*Leptotyphlops dulcis*) and night snake (*Hypsiglena torquata*). In fact, neither of these snakes is particularly rare on the Alexander property. The red-spotted toad, blind snake, and night snake are found throughout the eastern and western sections of the ranch. I view this area as possibly one of the most biologically significant and certainly one of the most herpetologically significant areas in the entire state.

In 1995 or 1996, a deliberate release of domestic pigs occurred near the old Roosevelt Ranch in southeastern Kiowa County, approximately 15 mi. northwest of the Alexander Ranch. Within two years of this release, my colleague, Ted Alexander, reported the occurrence of feral pigs to me on his property. These sightings included adults, juveniles, and new borns. Since the time of the release, feral pigs have been reported in southern Pratt County, eastern Comanche County, and they occur throughout the western two-thirds of Barber County (roughly the entire Gypsum Hills province in Kansas). The population center in Barber County appears to be along the Medicine River near Lake City, with perhaps a secondary center approximately 15 mi. south of Lake City. I have also received reliable reports of feral pigs in Clark County. These animals are obviously thriving and spreading throughout the Gypsum Hills and Red Hills Provinces of Kansas and are likely to spread southward into Oklahoma, if they have not already done so.

Up to the winter of 2000-2001, pigs had been confined to riparian areas of the south fork of Bear Creek on the eastern section of the Alexander Ranch. When disturbed, they might briefly flee into adjacent grassland but quickly returned to the creek area proper. Ted has reported only occasional sightings of pigs on the western section and none to date on the southern section. This is probably due to the fact there is no significant water on the southern section with no tree cover and intermittent water on the western section, although significant tree cover occurs here. Sightings, and occasional kills, have been concentrated from late fall to late winter, until this past spring.

This past spring, I observed considerable pig sign throughout the east study area at two sites. This sign consisted of scrapes, trenches, fecal matter, and footprints. Some sign was as fresh as two days old. It appeared that both adult and juvenile pigs were present. Pig sign has not been observed since late May of this year, although pigs are doubtless present in unknown numbers in creek bottoms adjacent to the study area. The primary pig daily activity period appears to be from late afternoon to sunset. Based on studies done at a feral pig site in Riley County, it is likely that pigs here are also nocturnal.

I believe that the reason that pigs have moved into the upland areas of the Alexander Ranch is directly attributable to the cold and harsh winter of 2000-2001. It seems logical to

hiding areas throughout the area. No predators, except for humans and the rare mountain lion, are capable of killing pigs, and there are too few of either in the area to amount to a significant control factor. Systematic elimination of most cedar stands would go far in reducing the amount of cover available to swine, but, without incentive to remove these trees, significant reduction is unlikely. Trapping has had limited success in the Riley County swine area, but pigs are smart and rapidly learn to move out of trap areas. As far as I know, there are no plans by any state agency to institute systematic pig control efforts in the Gypsum Hills.

Promoting pig hunting without bag limits has possibilities for effective control, but area landowners I have talked to are reluctant to allow such uncontrolled hunting, even though they are concerned about the pig problem. In addition, such hunting promotion may, in fact, provide financial incentive to not eliminate or reduce feral swine.

In the final analysis, effective control of feral swine in the Gypsum and Red Hills of Kansas must involve state agencies, conservation organizations, and, most important, active participation of local landowners to reach consensus on the most effective means to reduce and control this growing environmental problem in south-central Kansas.

NATURAL HISTORY OF THE NIGHTSNAKE, *HYP SIGLENA TORQUATA*,
IN KANSAS

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Collins (1993) states "Probably less is known about the natural history of (*Hypsiglena torquata*) than any other species in the state." Investigations since 1993 into the natural history of the herpetofauna of Barber County, Kansas have revealed additional records of this species that disclose significant information about this species' natural history and population status in Kansas, which I report herein.

METHODS

Data contained in this report have been gathered from both living and museum specimens (KU). SV, tail, and TL were measured for both living and preserved specimens. Mass was recorded for living specimens. Preserved specimens were dissected to reveal stomach and intestinal contents, sex, and eggs. Live specimens were either probed or visually examined to determine sex. Gravid females were palpated to determine egg number but ovulating females were not so treated because of potential follicle rupture. Most live specimens were scale-clipped and released at exact capture sites to track growth rates and determine population status at study sites on the Alexander Ranch in Barber County, Kansas. No live specimens have been preserved during the course of my field studies.

RANGE

Hypsiglena torquata is currently known from 23 preserved specimens from Clark, Comanche, and Barber Counties. Miller (1987) states that this "snake may be discovered in more counties along the southern border of Kansas." To the west, it is possible that *Hypsiglena* may occur in southeastern Meade County but it is unlikely that this snake occurs east of Barber County, as suitable habitat does not exist to sustain this species in that area.

To the north, it is probable that this snake occurs in southeastern Kiowa County, as a specimen has been found north of the Medicine Lodge River in adjacent Barber County. It may also occur in Red Hills outliers in Pratt and Kingman Counties, with Kingman being more likely than Pratt.

SEX RATIO

Of 33 specimens, living and preserved, examined during the course of this study, 16 were males and 17 were female, which is parity.

SIZE

Individuals captured in the course of this study have ranged from 161-334 mm in snout-vent length (SV). Adult males (n=5) ranged from 225-285 mm SV while adult females (n=6) have had SV's of 314-334 mm. Adult male tail length (T) ranged from 33-52 mm while female T ranged from 43-49 mm.

Preserved specimens ranged from 131-355 mm SV. Adult males (n=8) ranged from 201-270 mm SV with Ts of 49-61 mm. Two yearling males had SVs of 134 and 138 mm respectively, with Ts of 25 and 27 mm. Adult females (n=7) had SVs of 203-355 mm with Ts of 29-54 mm. Two yearling females had SVs of 131 and 136 mm respectively, with Ts of 19 and 20 mm. A single 2-year female had an SV of 160 mm with a T of 23 mm.

For all specimens, male T averages 20% of SV (range - 18.7-23.7%), while female T averages 15% of SV (range - 14.0-15.3%). This is a typical colubrid pattern, males having longer tails than females.

Adult males averaged 9.1 g mass (range 4.5-15.0 g) while adult females averaged 14.1 g mass (range 11.0-25.0 g).

REPRODUCTION

Male-female pairs have been found as early as 1 May and as late as 26 May, although copulation has not been observed. Tennant (1984) reports a 10 May copulation for a Texas pair.

Ovulating females have been found as early as 13 May with gravid individuals having been found from 25 May-9 June. One preserved specimen (KU 189386), collected 3 May 1981, contained 3 well-developed, but unshelled, ova. Hibbard (1937) reported a gravid Kansas specimen on 12 June. However, of seven adult females found by me in the prime breeding period, only three have been gravid. In addition, only one preserved female collected during the reproductive period contained eggs. This may indicate a biennial breeding cycle, although the total data set is obviously too small to draw a definitive conclusion.

Gravid females have contained 2-5 eggs. Hibbard (1937) reports a clutch of four eggs for a Kansas specimen and Collins (1993) speculated that Kansas animals may lay 2-6 eggs. Dundee (1950) records a clutch of six from Oklahoma and Degenhardt et al. (1996) list a range of 3-6 eggs in New Mexico. Tanner and Ottley (1981) reported a clutch of nine eggs for a Sonora, Mexico specimen. This appears to be the maximum clutch size for this species.

Time from mating to egg-laying (which I term latency and is not the same as gestation) for this species in Kansas remains unknown, although Dundee (1950) noted a female collected in Oklahoma on 5 June laid a clutch on 7 July, which indicates a latency period of no less than 33 days. A female found during this study that was ovulating on 13 May was found to be gravid on 9 June, a period of 28 days.

Hibbard (1937) states a 12 June egg-laying date and this remains the only such record for Kansas. Tennant (1984) reports that Texas *Hypsiglena* lay eggs from early April-late June and Fitch (1970) indicates the genus may have an extended reproductive period. Degenhardt, et al. (1996) report gravid females in New Mexico from late April-early

September and Tanner and Ottley (1981) give a 28 August laying date, all of which which corroborates Fitch's hypothesis. Degenhardt, et al. (1996) also indicate the possibility of multiple clutches. However, at least in Kansas and based on living and preserved specimens, the reproductive period appears to be much shorter, lasting from early May to mid-June.

Incubation period for Kansas animals also remains unknown. Tennant (1984) records 54 days for a Texas specimen and Tanner and Ottley (1981) report 59 days for a Sonora, Mexico specimen.

DIET

H. torquata has been recorded as consuming a variety of lizards, occasional snakes, and amphibians from elsewhere in its range (Degenhardt, et al. 1996; Webb, 1970). In Kansas, Miller (1987) reports *H. torquata* consuming *Tantilla nigriceps* and Collins (1993) states that this snake "feeds principally on small lizards."

Examination of gastrointestinal tracts from preserved specimens and fecal analysis of living specimens has revealed the following prey species in Kansas: *Cnemidophorus sexlineatus*, *Sceloporus undulatus*, *Phrynosoma cornutum*, *Eumeces* sp. (either *E. obsoletus* or *E. obtusirostris*), and *Leptotyphlops dulcis*. In addition, considerable remains from orthopteran and coleopteran invertebrates were found in feces but it is likely that these are artifacts of lizard prey, and not snake prey as reported by Tanner and Banta (1966). However, these secondarily consumed arthropods may contribute caloric or mineral nutrition to *H. torquata* individuals.

It is evident from the results of this study, that *H. torquata* is a reptile specialist in Kansas, with a preference for lizards. *H. torquata* is capable of immobilizing *C. sexlineatus* within 15 seconds of a bite (pers. obs.) and no doubt its venom is fully proficient in doing the same to other relatively unarmored species such as small *Crotaphytus* and *Phrynosoma*. Finding *Leptotyphlops* prey confirms Webb's anecdotal observation (1970).

ACTIVITY PERIOD

The earliest date of seasonal activity I have observed is 1 May and the latest date is 26 September. Miller (1987) records a 3 May date and Collins (1993) quotes a late date of 21 October. The vast majority of my observations of this snake (11) have been in May, with two records in June, and one September record. Preserved Kansas specimens have been taken as early as 17 April and as late as 21 October. These specimens were collected in April (3), May (3), June (5), July (1), September (1), and October (1). It appears that *Hypsiglena* is late emerging relative to other reptile species in Kansas but may have a long overall activity period (seven months). Peak observed activity is late May to early June, after which specimens probably disperse to underground retreats with the onset of very warm, dry weather. Cooler weather associated with moisture and the presence of neonate prey after August may stimulate a return to surface activity. If this species does estivate in Kansas, then its actual yearly activity period may only be 3-4 months.

Diel activity for this serpent is usually stated to be strictly nocturnal (Collins, 1993; Tanner and Banta 1966). Observations by me of specimens held briefly in captivity confirm this. Specimens only emerge from substrate retreats after full darkness and are active throughout the night.

BEHAVIOR

The Nightsnake is an inoffensive animal, never attempting to bite. I have observed two interesting defensive behaviors, though.

On two occasions, and involving three individuals, captured snakes have assumed a tight, ascending coil, which formed a low cone, with the head hidden in the center. All three individuals held this posture for several minutes, even allowing themselves to be turned upside down without uncoiling. All three snakes were found after unusually cold evenings and were relatively sluggish, and this posture may be related to the animals' relative inability to move. Price (1987) reports a similar behavior for a Texas specimen. I have seen photographs of *Hypsiglena* from as far away as California showing a similar pyramidal coil. However, the specimens were not hiding their heads in coils.

On another occasion on 6 May 1977, I placed an adult *Diadophis punctatus* with a similarly sized *Hypsiglena* from Clark County, Kansas. Upon being tongue-flicked and touched bodily by the *Diadophis*, the Nightsnake immediately assumed a stiff, C-shaped coil with the head and tail bent inwards at 60° angles. The head was depressed into the substrate and the upper third of the body was slightly raised. The *Hypsiglena* then violently bridged the *Diadophis*, literally throwing it a couple of inches. This behavior was repeated every time the Ringnecked Snake touched the *Hypsiglena*.

A large (382 mm TL) adult female *Hypsiglena* captured on 13 May was subsequently recaptured on 9 June of the same year. In this time, the individual had traveled a distance of ca. 70 m WNW of its previous capture site.

An adult male *Hypsiglena* was found on 29 May in contact association with an adult female *Sonora*. The *Sonora* was 21 mm longer and twice as heavy as the *Hypsiglena*, so it is doubtful that the *Hypsiglena* was seeking it as a prey item, although Degenhardt et al. (1996) postulate that *Sonora* is probable Nightsnake prey in New Mexico.

Hypsiglena appears to be adverse to water contact. Specimens held briefly in captivity react violently to be placed into water bowls to drink, attempting to flee at the slightest contact with water. It is unknown whether this snake actually drinks or depends on prey for its water needs, as is known for many desert vertebrates.

PARASITES

One specimen (KU 206236) contained numerous small nematode-like worms in the colon.

HABITAT PREFERENCE

Hypsiglena discovered in the course of this study have always been associated with limestone outcrops of south, west, or north exposures at 1800-1920 feet elevation. Under rock soil pH at these sites has ranged from 6.9-7.0, whereas exposed surface soils have

pH's of 5.8-5.9. Individual rocks chosen by *Hypsiglena* in this study generally are small- to medium-sized, although individuals may rarely choose large slabs. Miller (1987) reports finding two individuals hidden deeply within crevices in a large gypsum boulder. As this boulder appeared to have been the only available cover in sub-optimum habitat, it is possible it was used as a temporary refuge for migrating individuals. On the other hand, since the individuals were a male-female pair (KU #), it may be that the male pursued the female into an atypical hiding spot. It is possible that *Hypsiglena* may use gypsum boulders for refuge on a regular basis but I believe this unlikely when more suitable habitat is available.

The limestone outcrops referred to herein lie at canyon rims in the deeply dissected topography of the Gypsum Hills and Red Hills provinces of Kansas. Sandstones also occur in these provinces and it is possible that *Hypsiglena* may use this material for cover. I have never found this snake in association with gypsum, marls, or marl-like limestones, or imbedded, soft sandstones.

PREDATORS

There are no records of any predators feeding upon the Nightsnake in Kansas and I have not observed predation on this species. However, there are a number of potential vertebrate predators that have been observed in the area and I list them here: Coyote, Badger, Red Fox, Striped Skunk, feral pig, Longtailed Weasel, Raccoon, Grasshopper Mouse, American Kestrel, Merlin, Prairie Falcon, Mississippi Kite, Cooper's Hawk, Sharp-shinned Hawk, Greater Roadrunner, Eastern Screech Owl, Burrowing Owl, Long-eared Owl, Loggerhead Shrike, Blue Jay, Black-billed Magpie, American Crow, Eastern Collared Lizard, Great Plains Skink, Common Kingsnake, Coachwhip, and Eastern Racer.

It is likely that invertebrates may be the most important predators of *Hypsiglena* in Kansas. I believe the most probable candidates are the centipede (*Scolopendra* sp.), the striped scorpion (*Centruroides vittatus*), black widow spider (*Latrodectus mactans*), and tarantula (*Dugesiella hentzi*). All four are common to abundant in the area, known to take snake prey, and are primarily nocturnal. The scorpion and black widow are most likely to take neonate snakes due to their small size but the spider may take larger individuals because of its strong web and powerful venom. The tarantula and centipede are capable of consuming all size classes of Nightsnake.

POPULATION STATUS

Although uncommon, *Hypsiglena* does not appear to be particularly rare in the Gypsum Hills. I have found this snake at four different localities on the Alexander Ranch. These localities occur over a three linear mile area. In addition, adequate habitat for this snake occurs at a least 11 other sites on the ranch. During a brief initial survey of the Turkey Creek Ranch north of Sun City in Barber County, one specimen of this species was discovered after a 45-minute search.

To date, I have located 14 individuals of this snake over a six-year period. Prior to beginning work on the Alexander Ranch, only 23 *Hypsiglena* specimens were known from Kansas over a 55-year period.

Over this same six-year period, I have discovered 12 specimens of *Diadophis punctatus*, 9 specimens of *Sonora semiannulata*, and only one specimen of *Crotalus viridis* on this ranch, all allegedly common species in this area. None of these species has any legal protection in the state and the latter species has undergone a massive population decline in the Gypsum and Red Hills provinces of Kansas over the past 11 years.

Cattle ranching activities do not appear to have a detrimental effect on this snake and intensive rangeland management may, in fact, enhance habitat and food sources for this snake.

Obviously, farming agriculture would have a deleterious effect on *Hypsiglena* but habitat suitable for this snake is never suitable for farming in the Gypsum Hills and Red Hills

There are two potential threats at this time to *Hypsiglena* populations in Kansas. One is a recent introduction of feral pigs to the area and the other is explosive growth and expansion of red cedars (*Juniperus* sp.) throughout the area over the past 40 years.

Of the two threats, I believe that pigs represent a minimal threat at this time. The feral pig population appears to have stabilized over the past two years in Barber County and is mostly confined to creek and river floodplains. Pig sign has been observed on the Alexander Ranch in *Hypsiglena* habitat on one date in two localities. These observations were made after a particularly harsh winter that may have forced pigs to forage in areas that they normally would not. It could not be determined if pigs were present when *Hypsiglena* were active.

The spread of the red cedar, on the other hand, may represent a real threat to *Hypsiglena* populations in certain areas of the Gypsum Hills. This tree has a tendency to emerge from creek floodplains and canyon bottoms and spread up to and enclose canyon ridgelines, which is primary *Hypsiglena* habitat. The enclosing cedar canopy removes open areas upon which the heliothermic prey of this snake depends. In other words, cedars drive out *Crotaphytus*, *Cnemidophorus*, and *Sceloporus*, the primary foods of *Hypsiglena* in this area.

The exact extent of cedar infestation in the Gypsum Hills is unknown at this time. A wildfire in 1993 destroyed most cedars in the southwestern 1/4 of Barber County and they have not returned since then. A controlled burn between the Sun City and Lake City Roads on the west and east and U.S. Highway 160 and the Medicine River Road on the south and north in 1997 eliminated a majority of cedars in that area. Smaller burns and active cedar cutting have occurred at a variety of localities in western Barber County over the past six years. However, a large area of central Barber County appears to be increasingly threatened by cedar encroachment. If suitable Nightsnake habitat occurs in this area, and it appears that it does, then these populations may be at risk. Cedar encroachment in the Red Hills provinces of Comanche and Clark Counties does not appear to approach that of central Barber County and I do not deem this a risk to *Hypsiglena* in those counties.

Cedars can easily be controlled with fire and subsequent intensive grazing management practices. Land so managed in this area is enhanced for all species, including the Nightsnake.

Hypsiglena torquata is currently listed as a Threatened Species by the Kansas Department of Wildlife and Parks (KDWP). The primary factors in giving the species such status appear to be its limited range in Kansas (three counties) and small numbers of

museum specimens at the time of listing, despite no actual evidence of a demonstrated threat to the snake.

Because the Nightsnake appears to be more common than previously thought (in fact, more common than currently unprotected species) and no demonstrated threat (other than cedar encroachment in limited areas) has been proven to exist, I propose that *Hypsiglena torquata* be downlisted by KDWP from Threatened Species to Species-in-Need-of-Conservation (SINC). This status still affords the species legal protections and allows other workers to concentrate on other species whose populations may actually be threatened.

SUMMARY

The Nightsnake occurs in three Kansas counties and may yet be discovered in Kiowa (likely), Meade, Pratt, and Kingman Counties.

This species' sex ratio is at parity in Kansas.

The smallest specimen from the state is 131 mm snout-vent length with a tail length of 19 mm. The largest specimen is 355 mm snout-vent with a tail length of 54 mm. Tail length averages 20% of snout-vent length in males and averages 15% snout-vent length in females.

The reproductive period for this snake is late April-mid-June. Courtship may occur from late April-late May with ovulation occurring as early as 3 May. Egg-laying probably occurs from late May-mid-June with hatching sometime in mid-July-early August. There does not appear to be an extended reproductive period for this serpent in Kansas as may occur elsewhere in its range.

Hypsiglena prefers lizard prey here but also takes small snake prey.

This snake is active from mid-June to late October but is most active from May to mid-June. It appears to have an activity period of seven months in Kansas but its actual activity period may only be 3-4 months if it estivates.

The Nightsnake never attempts to bite and engages in an unusual head-hiding behavior that is widespread in the species. It also exhibits an unusual bridging behavior. Specimens are capable of moving as much 2.6 ft per day. This snake may also not drink but gain water metabolically.

This snake prefers limestone outcrops at canyon rims but may rarely use gypsum rock for cover. It is possible that it uses sandstone cover if available.

Potential predators include a number of mammals, birds, reptiles, and invertebrates. It is likely that invertebrates are the most significant predator on this serpent.

The Nightsnake is more common than previously thought. The only current threats to this species appear to be feral pigs and red cedar invasion, both of which are minimal in the overall context of this snake's range in Kansas. I recommend that *Hypsiglena torquata* be downlisted from Threatened Species to Species-In-Need-of-Conservation.

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