

Predation and Behavioral Interactions between Horned Lizards and Arid Land Foxes

Howard O. Clark, Jr.

H. T. Harvey & Associates, Fresno, California, USA; hclark@harveyecology.com

Juvenile Desert Horned Lizard (*Phrynosoma platyrhinos*), San Bernardino County, California. Photo by Howard O. Clark, Jr.



reporting horned lizards in the stomach contents of a Kit Fox, but Snow (1973) obtained her information from Cutter (1958), who actually studied the stomach contents of a Swift Fox (see above). Duncan et al. (1994) found chewed, but uneaten, lizard remains on an active Kit Fox den mound and reported that the Kit Fox was the only mammalian predator identified for the Flat-tailed Horned Lizard (*P. mcallii*) during their study about 10 km east of Fish Creek Mountains, Imperial County, California.

In addition to these findings, Sherbrooke and Middendorf (2004) conducted a series of fascinating experiments to determine if the blood-squirting behavior exhibited by Texas Horned Lizards is a canid antipredator defense, as it is beneficial for the horned lizard to deliver irritant-laden blood into the mouth of a potential predator before being fatally mauled (Sherbrooke, 2003; Hodges, 2004). Middendorf et al. (2001) observed interactions between horned lizards and Kit Foxes and concluded that it is not the blood squirting that is the defense mechanism, but that the blood itself contains an irritant that deters the foxes. The experiments, conducted with four captive juvenile Kit Foxes, showed that naïve “hungry” foxes killed and ate adult Yarrow’s Spiny Lizards (*Sceloporus jarrovi*) and Texas Horned Lizards. The foxes exhibited head shaking behavior in five of six trials in which Texas Horned Lizards squirted blood. When mice were applied with horned-lizard blood and fed to foxes, the foxes shook their heads as if the mice were actually horned lizards. When fed untreated mice and mice covered with mouse blood, foxes did not behave in this manner, demonstrating that *Phrynosoma* blood and its chemical properties altered the foxes’ normal behaviors toward mouse prey.

Interactions between foxes and horned lizards make an interesting topic to explore, however sparse the literature. In two locations, a species of horned lizard is known to co-occur with a desert fox species. The Coast Horned Lizard (*Phrynosoma coronatum*), a California species of special concern found in the San Joaquin Valley, co-occurs with the San Joaquin Kit Fox (*Vulpes macrotis mutica*), and the Desert Horned Lizard (*Phrynosoma platyrhinos*) co-occurs with the Desert Kit Fox (*Vulpes macrotis arsipus*). There are no records of predation of either of these horned lizard species by these foxes, although based on my review of the literature, it is certainly possible to have occurred.

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One would think that a lizard with horns would be something a fox would consider too risky to attack and eat (see Young et al., 2004). However, based on a review of the small amount of literature on predation of horned lizards by kit and swift foxes, it appears that foxes do eat horned lizards, but as an opportunistic prey item, not a frequent food staple. Whether this is because of successful anti-predator behaviors displayed by the lizards or that the lizards themselves are not common enough on the landscape to serve as an important food item is not known. Herein, I summarize the literature on predation of horned lizards by kit and swift foxes and examine the associated behaviors exhibited by these species.

Records of predation of horned lizards by foxes are scarce; however, the few records that do exist are important to note because they serve to supplement the literature on the behavioral interactions of these species. In Hansford County, Texas, Cutter (1958) collected 12 Swift Fox (*Vulpes velox*) stomachs and 250 scats from six localities. Four lizards were found in three scats and one stomach: three were identified as the Eastern Fence Lizard (*Sceloporus undulatus*), the Texas Horned Lizard (*Phrynosoma cornutum*), and the Six-lined Racerunner (*Aspidoscelis sexlineatus*), and the fourth lizard could not be identified. Burns (1960) found a road-killed Kit Fox (*Vulpes macrotis*) along U.S. Highway 70 in Doña Ana County, New Mexico. Examination of stomach contents yielded two small horned lizards, swallowed whole. The horned lizard consumed by the fox was likely one of three species of *Phrynosoma* found in New Mexico: Texas Horned Lizard (*P. cornutum*), Greater Short-horned Lizard (*P. hernandesii*), or Round-tailed Horned Lizard (*P. modestum*; Sherbrooke, 2003). Middendorf and Sherbrooke (1992) cite an unpublished document (Snow 1973) as

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CURRENT RESEARCH SUMMARY

Phylogeography and Species Boundaries of the Nightsnake

The subspecies concept has received considerable debate throughout the past century. Subspecies were originally used to delineate potential incipient species, but were later employed to simply capture geographic variation. There is a recent trend to eliminate the trinomial in light of new evidence. Discrete, diagnosable lineages are elevated to specific status, while those that show clinal variation or appear to represent ecological pattern classes are placed in synonymy with the parent species and the subspecific epithets are disregarded.

The author of the current study examined the species boundaries of Nightsnakes (*Hypsiglena torquata*) using phylogeographic methods and mtDNA data from 178 individuals. Previously, 17 subspecies of *H. torquata* were described. Here, the author recognized 6 species in what was previously considered *H. torquata*. One species is novel, the Cochise clade (*H. sp. nov.*, Hooded Nightsnake), and occurs in southeastern Arizona. Two were previously recognized subspecies, the Sinaloan (*H. torquata*) and Rio Grande de Santiago (*H. affinis*) nightsnakes. The remaining three are widespread, polymorphic lineages composed of multiple subspecies. The Chihuahuan Nightsnake (*H. jani*) occurs in the Chihuahuan Desert, Great Plains, and southeastern Colorado Plateau, with *H. j. texana* (Texas Nightsnake) entering southeastern Arizona north of the Cochise clade and northeastern Arizona on the Colorado Plateau. The Desert Nightsnake (*H. chlorophaea*) ranges from near Alamos, Sonora, through the Sonoran and Mojave deserts, to the Great Basin and the northern Colorado Plateau. Three subspecies occur in Arizona: the Sonoran Nightsnake (*H. c.*



Sonoran Nightsnake (*Hypsiglena chlorophaea chlorophaea*), as recognized by Mulcahy (2008), from the Rocking K Ranch east of Tucson. Photo by Roy C. Averill-Murray.

chlorophaea) throughout the Sonoran Desert, the Great Basin Nightsnake (*H. c. deserticola*) on the Arizona Strip, and the Mesa Verde Nightsnake (*H. c. loreala*) in the Four Corners region. Finally, the Coast Nightsnake (*H. ochrorhyncha*) ranges from the cape of Baja California to the San Francisco Bay.

The author suggests maintaining the subspecific lineages in the wideranging species because they are geographically cohesive, morphologically discrete, and may represent incipient species within each complex, which have not yet achieved speciation. Maintaining these subspecies' designations facilitates future investigations, as well as provides a useful identity for the taxonomy of this diverse lineage.

- Mulcahy, D.G. 2008. Phylogeography and species boundaries of the western North American Night Snake (*Hypsiglena torquata*): revisiting the subspecies concept. *Molecular Phylogenetics and Evolution* 46:1095-1115.

