Diurnal activity and a minimum population density estimate of the Colorado Desert shovel-nosed snake, *(Chionactis occipitalis annulata)*

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The Colorado Desert shovel-nosed snake, *Chionactis occipitalis annulata*, has been described as a small, nocturnal, desert dweller (Stebbins 1985, Klauber 1951). Several reports of diurnal activity appear in the literature (see review in Brattstrom 1952), but observations of such activity are rare. Abundance or population densities of shovel-nosed snakes have not been determined, although based on a low rate of recapture during pitfall trapping in Nevada, Turner (1977) suggested snakes either avoided traps or a large resident population was present. Herein I describe diurnal activity and a minimum population estimate for the Colorado Desert shovel-nosed snake in the Yuma Desert, Arizona.

From May 1990 to August 1992 I monitored flat-tailed horned lizards (*Phrynosoma mcallii*) and horned lizard scat occurrence on two 3.61 ha plots located in the Yuma Desert approximately 24 km south of Yuma, Arizona. In an attempt to conduct intensive mark and recapture and determine densities of flat-tailed horned lizards, the plots were systematically searched for lizards and scat for a total of 79.2 hrs during 2-10 May 1992. The plots were staked in a 10X10 m grid, and rows of stakes were walked systematically back and forth across the plots during daylight hours. Methods, precise locations of plots, and results are detailed in Rorabaugh (1994). The effort failed to yield enough flat-tailed horned lizard captures to calculate density; however, a large number of Colorado Desert shovel-nosed snakes were encountered incidental to the horned lizard work.

After encountering 3 shovel-nosed snakes in the first 3 hours of searching the south plot, I decided to mark captured snakes with Testors silver paint and record basic capture information. Snakes were given individual marks by painting dorsal black crossbands. Anomalous markings, such as incomplete black or red bands, scarring or missing tails, and the color (black or red) on the end of the tail were recorded. The time the snake was first observed, the surface temperature in the sun at or near to where the snake was first seen, and the location of the snake in the plot grid system were also recorded. After it became clear that horned lizard captures might be marginal or inadequate for population estimates on both plots, I focused my efforts on the south plot.

A total of 36 shovel-nosed snakes were observed during the day on the two plots, including 29 snakes during 50.2 hrs on the south plot (0.58 snakes/hr) and 7 snakes during 29.0 hours on the north plot (0.24 snakes/hr). Thirty-one snakes were marked, including 25 on the south plot and 6 on the north plot. One animal was recaptured on the south plot. It was first captured at 0945, 9 May, and then recaptured approximately 37 m southeast of that location about 2 hrs later. All marking of snakes on the south plot occurred over a 5-day period. All snakes were observed when surface temperatures in the sun were 24-46 °C (mean=32 °C). Seventy-six percent of snakes were found from 0635-1215, with the remainder found from 1500-1930. All snakes observed were strongly tricolored (Figure 1) and none appeared to be young-of-the-year.

I did not know how long paint marks would remain visible given the active, and often fossorial, lifestyle of *Chionactis*. I feared that I might be recapturing snakes during this adhoc exercise for which their paint marks had already eroded away. To better understand the lifespan of paint marks on these snakes, I maintained a captive shovel-nosed snake from the south plot in a 5-gallon aquarium at 23-27 °C. Aquarium substrate was sand from the south plot. I marked the snake with Testors silver paint on 8 different occasions at varying locations on the dorsum and then noted how long each paint mark persisted. Paint marks lasted 2-18 days (mean=6.7 days). Only one paint mark lasted less than 4 days; however, this exercise suggested that some of the snakes I captured and recorded as new individuals may have been recaptures. If we conservatively assume that paint marks lasted only 2 days on all individuals, then at least 16 shovel-nosed snakes (4.4/ha) inhabited the south plot during 8-10 May (the maximum number of new captures in a 2-day period). If we assume marks lasted 4 days on all individuals, then at least 22 shovel-nosed snakes (6.1/ha) inhabited the south plot from 5-9 May. If there was really only one recapture, then at least 28 snakes (7.8/ha) inhabited the plot from 5-10 May. These minimum density estimates equal or exceed the density of flat-tailed horned lizards on the plots, which probably were no greater than 4-5/ha (Rorabaugh 1994, Young 2000). The data also suggest *Chionactis* densities are likely similar or perhaps greater than some of the common lizards in the Yuma Desert, including *Cnemidophorus tigris*, *Uma notata*, and *Callisaurus draconoides* (see review in Turner 1977, Turner and Schwalbe 1998).

The diurnal encounter rate of shovel-nosed snakes during May 1992 was unusually high. During 62.4 hrs of surveys on the plots during 1990-1992 (excluding May 1992), only 4 shovel nosed snakes were observed (0.064/hr – or only 14 % of the encounter rate during May 1992), although the distinctive serpentine tracks of *Chionactis* were often abundant in the windblown sand of the plots. Furthermore, during 91 hours of flat-tailed horned lizard surveys in April-May 1985 (Rorabaugh *et al*. 1987), no shovel-nosed snakes were found. Unusually cool and overcast conditions during the surveys in May 1992 may have encouraged diurnal activity by *Chionactis*. Alternatively, the study site may simply be unusually good habitat for *Chionactis*.

In conclusion, it is interesting that snake densities can reach such high levels in one of the driest (about 8.7 cm of rain annually) portions of the Sonoran Desert. It is also intriguing that this so-called nocturnal snake can, on occasion, be so diurnal. All this begs further investigation.

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Figure 1: Colorado Desert shovel-nosed snake on the south plot, Yuma Desert, Arizona