Great Basin Naturalist 55(3), © 1995, pp. 282–283

SALTATION IN SNAKES WITH A NOTE ON ESCAPE SALTATION IN A *CROTALUS SCUTULATUS*

Breck Bartholomew[1] and Robert D. Nohavec[2]

Key words: Crotalus scutulatus, *escape saltation, behavior.*

Escape saltation and aggressive saltation have been reported in relatively few snakes (Gans and Mendelssohn 1971, Klauber 1972, Gans 1974, Armstrong and Murphy 1979, Gasc 1994). These reports range from the incredulous to the well documented. Gasc (1994) relates an unbelievable case of jumping in *Atropoides* (=*Porthidium*) *nummifer* in which individuals "tend to jump, either when they hit a prey or *to clear a height of up to 3 ft (1 m),* starting from a low point [emphasis added]." Certainly *A. nummifer* may jump; however, in their decades of experience with hundreds of these snakes in both the wild and captivity, W. Lamar, L. Porras, and A. Solorzano have never seen nor heard of this behavior (personal communication). It is possible that *A. nummifer* may appear to jump as they strike from an arboreal perch (i.e., a log) and fall to the ground (L. Porras personal communication).

The best reports of ophidian saltation are those of Gans and Mendelssohn (1971) and Gans (1974). These authors analyzed *Bitis caudalis* jumping behavior in terms of stimulus and biomechanics. They determined that *B. caudalis* weighing less than 23.5 g, with a body temperature between 31°C and 37°C, were able to jump using sidewinding locomotion. This type of saltation is energetically expensive, and jumping snakes tire quickly.

Believable reports of rattlesnake saltation are relatively few. Klauber's (1972) reports consist primarily of exaggerated accounts of rattlesnakes jumping while striking at either prey or man. However, one of his reports cannot be ignored:

> Dr. R. B. Cowles told me that he was always skeptical of stories of rattlesnakes leaving the ground in the course of a strike, until he saw this done two or three times by an angry southwestern speckled rattler (*Crotalus mitchellii pyrrhus*). The snake was on pavement and struck for more than its full length.

The only other report of rattlesnakes jumping is of *C. scutulatus salvini* which "struck so violently that their entire body appeared to be momentarily air borne" (Armstrong and Murphy 1979). Neither of these reports discusses the biomechanics of how these snakes jumped. Since both accounts are of aggressive saltation, and neither of the species typically utilizes sidewinding locomotion (Cowles 1956, Klauber 1972), the biomechanics involved in rattlesnake saltation is likely different from that in *B. caudalis.* Here we report an instance of escape saltation in a wild *C. s. scutulatus.* Although our observations are anecdotal, we believe they offer important insight into the biomechanics of rattlesnake jumping.

On 4 September 1993 we observed an unusual flight behavior by a wild *C. s. scutulatus* in the Hualapai Mountains, Mojave County, AZ. When approached, the snake lunged forward using its tail as the origin of force. This lunge was powerful enough to cause the snake's entire body to lift off the ground (Fig. 1). Actual forward movement from this "jump" was minimal, and the snake recoiled into a series of tight S-curves and jumped again. This type of saltation was observed a total of four times. None of the four jumps were directed toward a person, and the snake's mouth appeared to remain closed.

Of the four types of snake locomotion, this jumping behavior could only be accomplished using concertina, in which the tail is the main point of force during foward movement. Klauber (1972) noted that rattlesnakes use concertina movement for slow progression in open areas and where restraints are involved (i.e., smooth

[1]195 West 200 North, Logan, UT 84321-3905.
[2]Venom Research Laboratory, Veterans Administration Medical Center, Salt Lake City, UT 84148-151H.

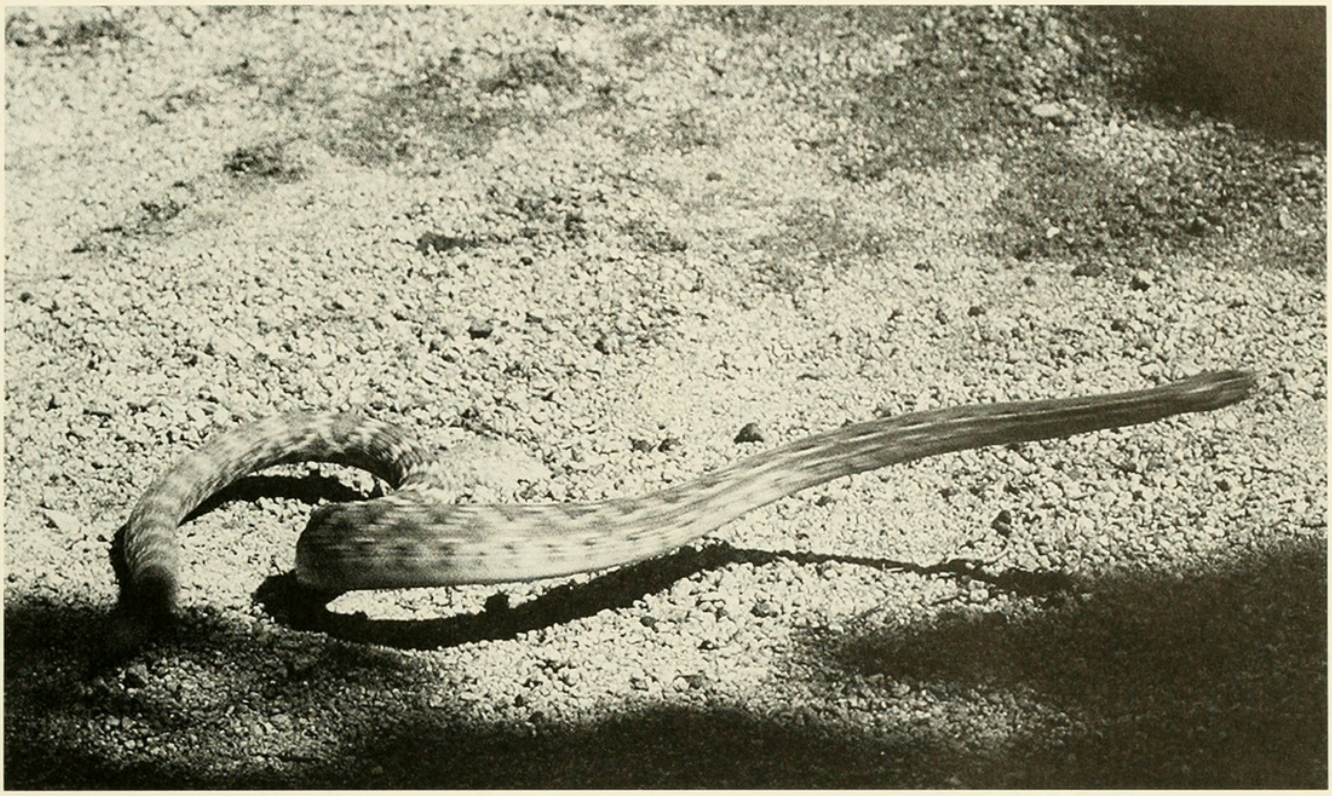

Fig. 1. *Crotalus s. scutulatus* exhibiting escape saltation. Photograph taken just before the tail left the ground.

surface or narrow channel). Neither of these circumstances was applicable to this particular situation. The use of concertina locomotion rather than sidewinding as a basis for jumping in this snake is understandable as an antipredator response. *Crotalus s. scutulatus* typically utilize quick serpentine locomotion during flight; Klauber (1972) noted they are rather clumsy sidewinders. By reducing the number of pressure points to one (e.g., the tail), the snake changed from serpentine to concertina locomotion. Whether this change is an effective use of energy remains to be tested. However, given the short distance the snake traveled, it would appear the relative energy cost would be high.

ACKNOWLEDGMENTS

We thank Louis Porras, William Lamar, and Alejandro Solorzano for the information they provided about *Atropoides nummifer.* James Glenn offered the financial assistance that made these observations possible.

LITERATURE CITED

ARMSTRONG, B. L., AND J. B. MURPHY. 1979. The natural history of Mexican rattlesnakes. University of Kansas Museum of Natural History Special Publications 5: 1–88.

COWLES, R. B. 1956. Sidewinding locomotion in snakes. Copeia 1956: 211–214.

GANS, C. 1974. Biomechanics: an approach to vertebrate biology. University of Michigan Press, Ann Arbor. 261 pp.

GANS, C., AND H. MENDELSSOHN. 1971. Sidewinding and jumping progression of vipers. Pages 17–38 *in* A. de Vries and E. Kochva, editors, Toxins of animal and plant origin. Gordon and Breach, New York.

GASC, J.-P. 1994. Locomotion. Pages 60–75 *in* R. Bauchot, editor, Snakes: a natural history. Sterling Publishing, New York.

KLAUBER, L. M. 1972. Rattlesnakes: their habits, life histories, and influence on mankind. University of California Press, Berkeley. 1536 pp.

Received 14 September 1994
Accepted 29 November 1994