

Borderland Blacktails: Radiotelemetry, Natural History, and Living With Venomous Snakes

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The problem of repeatedly locating free-living snakes for observation has been solved for some species by surgical implantation of miniature radio transmitters (Reinert, 1992; Greene, 1994). Using that technology, we are studying black-tailed rattlesnakes (*Crotalus molossus*) in the Chiricahua Mountains, Cochise County, Arizona. Blacktails occupy upland habitats from Arizona to Texas and south onto the Mexican Plateau; adult males reach 1.33 m in total length (Hardy and Greene, 1995) and weigh up to 1.4 kg, whereas females are somewhat smaller (Lowe et al., 1986). Our primary goals are to assemble a detailed behavioral inventory for that species, as part of an effort to understand the ecological and evolutionary diversification of snakes (e.g., see Greene, 1992, 1997), and to publish an extensively illustrated, monographic account of its biology. We also hope to inspire others to study and appreciate such secretive, beautiful, and often unpopular predators. This interim report describes some emerging generalizations about blacktail natural history and comments on the integration of our scientific activities with local human concerns.

Methods

We work in Silver Creek Canyon, about 3.3 km NW of Portal, literally and figuratively on the road to Paradise; the site is about 1.6 km wide and 2.5 km long, 1550-1800 m in elevation, and bordered on the NE by Limestone Mountain. Initially we located snakes by random encounters, and because blacktails are exceptionally cryptic, our sample at first grew slowly. However, telemetered males locate females and those females attract more males; since 1988, we have studied 39 snakes for periods of a few weeks to more than eight years.

We want to observe normal behavior and minimize stress to the study animals, but snakes evidently interpret manual restraint as a predatory attack, in response to which they struggle, may be injured, and may be psychologically traumatized. We therefore handle them gently with tongs, hooks, and plastic tubes (Murphy, 1971), and use inhalation anesthesia for examination and transmitter implantation (Hardy and Greene, 1999). We locate each snake about once a month during the winter, every week or two in the spring, and at least once a day from late July until September. Observations are made with binoculars from a distance of several meters, and snakes seldom overtly react to our presence. Until recently we identified untelemetered snakes on the study area with drawings of unique head markings. Since 1998 we have used passive integrated transponders or "PIT tags" (small glass covered bar codes, injected intraperitoneally) for permanent identification.

Preliminary Findings

Home ranges average about 300 x 700 m for adult males, 150 x 250 m for non-gravid females, and 2 square meters for gravid females; home ranges are irregularly elliptical, with winter sites at their upslope boundaries. Blacktails occupy idiosyncratic and highly repeatable areas, returning year after year to particular rock shelters, rodent nests, prickly pear patches, and so forth.

Chiricahua blacktails prey mainly on mammals, as is the case elsewhere (e.g., Klauber, 1956). We have recorded desert cottontails (*Sylvilagus audubonii*), rock squirrels (*Spermophilus variegatus*), and cliff chipmunks (*Eutamias dorsalis*) in the diets of adults, but their staple is the white-throated woodrat (*Neotoma albigula*). During warm weather blacktails are typically in shade or out of sight beginning at late morning, but in late afternoon and shortly after dawn we often find them hunting in a tight coil and ready to strike: tail hidden, neck in an S-shape, head forward and level with the ground (Fig. 1). Putative ambush coils usually are near

Figure 1. Black-tailed rattlesnake (male No. 9, now under study for eight years) hunting next to a cottontail runway (foreground), having perhaps waited there all night. From a color slide by D. L. Hardy Sr., 0800 hr, August 9, 1996.



an obvious runway, trail, or nest entrance, and we presume hunting sites are identified from prey odors (Ford and Burghardt, 1993). We watched one unsuccessful strike at a cottontail and the trailing of another envenomed rabbit over a distance of about 90 m. Blacktails seek shelter after feeding and sometimes enhance digestion by exposing to sunlight only that section of the body with the food lump.

Blacktails emerge from winter inactivity by early April but, presumably due to dry surface conditions, are often inactive until summer. With the onset of monsoon rains in July, males may move hundreds of meters daily, often in fairly straight lines and evidently searching for pheromonal trails of females. A courting male exhibits a crescendo of "forward body jerks" along a female's back for 30-45 sec, then makes rapid tail-searching movements against her vent. Usually the female beats back his tail with hers and moves away, with the male quickly following her, and these bouts are repeated many times. Persistent males copulate with receptive females, and the latter store sperm in their oviducts until the following spring, when they ovulate, fertilize, and gestate. Males may engage in ritualized combat when near a female, with each male attempting to rise above and topple his rival, but this is rare or at least rarely observed.

We have watched five telemetered females, from mating through postnatal attendance of the young. Upon spring emergence, inseminated females settle at individual shelters, 50-150 m from their hibernacula; these birthing sites are in rodent excavations under boulders, characterized by a dirt floor and an E or SE exposure. Gravid females bask in the early morning, sometimes with only the posterior portion of the body exposed to the sun and the remainder in shelter, then withdraw out of sight for the remainder of the day and night. Births occur in late July or early August, after the first heavy monsoon rains. Female No. 21 delivered two litters of six young each, separated by two years of non-breeding, at different but nearby birthing sites. During the second gestation, we replaced her failing transmitter without problems; young of that litter averaged longer and heavier than those in three other litters. Postpartum females remain in place until the young complete their first sheds, about 8-10 days after birth. Mothers and babies bask in the morning, and retreat into shelter if approached closely; elsewhere a female with young rattled and stood her ground (Savary, 1998). One to three days following neonatal ecdysis and dispersal, postpartum females move to summer ranges and hunt.

Maternal care is widespread in pit vipers, and a likely role for blacktails is protection of the clumped young. Neonate rattlesnakes are sensitive to desiccation because of small size and formation of the new layer of skin, and aggregation reduces water loss (Duvall et al., 1985). Moreover, their eyesight and infrared pit function are probably hampered by the shedding cycle, and they surely are less capable of defense against a large predator than are adults. Seven species of mammalian carnivores as well as various raptors inhabit Silver Creek Canyon, and a gray fox (*Urocyon cinereoargenteus*) and pups denned within a few meters of one blacktail birthing site. Thus, although she might well otherwise catch a meal, a blacktail could substantially enhance survival of her young by attendance during the ten-day neonatal aggregation.

We are particularly interested in the behavior of young snakes, so in August 1998 we gently captured and PIT-tagged litters of 3, 4, and 6 young for future study. Two neonates were also implanted with transmitters, and returned to their siblings and mother without incident the following day. Both juveniles were secretive during the ensuing four months, and moved 150 and 650 m from their birthing site. Young snakes hunt formidable prey, as illustrated by a three-week-old, 20 g blacktail in Portal that had eaten a 26 g brush mouse (*Peromyscus boylii*).

Silver Creek blacktails hunt until mid-October and by early December have migrated to winter refuges, high on the canyon slopes. Most individuals return to the same sites year after year, and two males have used the same refuge for seven years. Some snakes move 100-200 m up slopes adjacent to their summer ranges; others travel up to 1.5 km east into an adjacent side canyon, utilizing sites at similar elevations to those of the first group.

Some Closing Thoughts

Our ongoing field studies of blacktails, like those of several other species (e.g., Duvall et al., 1985; Reinert et al., 1984), illustrate that direct observation of secretive, wary, venomous snakes can be conducted with minimal disturbance of the animals or risk to investigators. We have recorded diverse maintenance and social behaviors of this species, and accumulated thousands of color slides representing most aspects of its natural history. Our strongest, admittedly subjective, impression from this close contact is that snake behavior in nature is far more complex than previously realized. We suspect that blacktails learn about specific habitat features as they grow and enlarge their home ranges, and that this experience facilitates their advantageously repetitious use of the landscape. It is for that reason we focus on long-term observations of individual animals, and that we now seek to emphasize studies of young rattlesnakes.

Dealing with rattlesnakes near dwellings is problematic, in that while some people might commendably not kill the snakes, many also would not like a dangerous animal hiding in the immediate vicinity. A common response (e.g., in Tucson) is to define all rattlesnakes near homes as “problems” and relocate them many miles away. However, most experimentally translocated timber rattlesnakes (*Crotalus horridus*), even in ecologically appropriate new sites, fail to thrive and slowly perish (Reinert et al., 1999). Because blacktails repeatedly and idiosyncratically use multiple habitats, they probably profit from experience in a specific landscape and also would do poorly if translocated. We prefer that people cautiously accommodate resident blacktails and displace them no more than a few hundred meters away from the immediate vicinity of houses, children, and pets. If the snakes cannot be tolerated in the general area, immediate euthanasia might be a more humane fate than translocation.

Portal is a small community, and most citizens as well as some nearby ranchers are aware of our study. In cooperation with local resident Barney Tomberlin, we routinely respond to calls to move rattlesnakes away from houses; we escort interested individuals to view telemetered snakes and we have given several slide shows to local groups about our work. People often seem surprised that rattlesnakes are preoccupied with diverse and interesting activities; we show our guests that blacktails sleep, drink, bask, shed their skins, hunt rodents, eat astonishingly huge meals, mate, fight with each other, give birth, attend to their young, and avoid danger—but that these shy snakes are defensive only when directly threatened, and even then only if they cannot otherwise escape. Our subjective but strong impression is that folks are less likely than they were ten years ago to view rattlesnakes with instant alarm, and they are more willing to tolerate and even grudgingly admire these creatures.

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