have been found. Significantly, in 1994, a year in which active season temperatures were near normal, at least one pregnant female seen at a birthing rookery in mid-September at the Grant Co. site, as well as a female from a high elevation Blue Ridge site, returned to overwintering dens for parturition at the time when ingress was in progress in late September (Table 1).

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CROTALUS HORRIDUS (Timber Rattlesnake). **CLIMBING.** While tracking timber rattlesnakes (N = 12) during a telemetry study in Nacogdoches County, Texas, USA, we captured an immature female *C. horridus* (75.4 cm SVL, 173.5 g WT) on 1 April 1993 and implanted a transmitter subcutaneously. On 10 August 1993 we located the snake 3.5 m above ground on small limbs (1 cm diam) of an 11 cm DBH American hornbeam (*Carpinus caroliniana*). On 18 August 1993 the snake was found 52 m from the previous location on the ground. Nine months later, 5 May 1994, we found the same snake 7 m up in a tangle of greenbriar (*Smilax* sp.) and small limbs of a 40 cm DBH willow oak (*Quercus phellos*). The next time we found the snake, 10 May 1994, it was found in small tertiary limbs 9 m above ground in the same tree, which is much higher than ever reported for this snake species.

The size of the rattlesnake was probably an important factor in its ability to climb. Rudolph (1990. Wilson Bull. 102(1):14–22) found that smaller *Elaphe obsoleta* were more adept climbers than larger ones, so it is not surprising that the only rattlesnake we observed climbing was the smallest in the study (snakes ranged in size from 75.4 cm SVL, 173.5 g to 137.2 cm SVL, 2654 g). We did not find evidence of a bird nest or flood waters in the immediate vicinity of the climbing snake which might cause this unusual behavior.

We thank Fred L. Rainwater, Paul D. Klawinski, and Bob R. Fleet for constructive comments on an early draft of this note.

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CROTALUS LEPIDUS (Rock Rattlesnake). **AQUATIC BEHAVIOR.** On 5 August 1995 at ca. 1700 h, MST, I observed aquatic behavior in *Crotalus lepidus* at the South Fork Negrito Creek (NW 1/4 of SW 1/4 Sec. 32, T8S, R17W, elevation ca. 2141 m), Catron County, New Mexico, USA. Here, the creek flows through a rocky, sheer-sided canyon 73 m deep, where several *C. lepidus* were observed. I observed a *C. lepidus* (40 cm TL) submerged in a 1 m deep, 2 m x 3 m pool; air temperature was approximately 35°C while the water was approximately 16°C. The snake was lying on a rock ledge under 0.5 m water adjacent to the central, deepest portion of the pool. The snake was completely submerged with its head and anterior portion of body elevated and suspended over the deeper water. Numerous small fishes also were in the pool swimming in the deep water. It appeared the rattlesnake could have been foraging for these fish. After observing the snake for several minutes I disturbed it while attempting to catch it. The snake swam to the surface and then across to the edge of the pool. I subsequently was unable to find it.

Crotalus lepidus swims well, although aquatic behavior in rattlesnakes is rare (Klauber 1972. Rattlesnakes: Their Habits, Life Histories, and Influence on Mankind. 2nd ed. Univ. California Press, Berkeley. 1533 pp.). The aquatic behavior I observed may be attributable to either thermoregulation or foraging. *Crotalus lepidus* is mostly diurnal but seeks cool shelter during the hottest part of the day (Ernst 1992. Venomous Reptiles of North America. Smithsonian Inst. Press., Washington. 236 pp.). Cool water could offer such a shelter. Unlike most rattlesnakes, *C. lepidus* tends to rely on vision for foraging and feeds mostly on exothermic prey, particularly lizards (Ernst 1992, *op. cit.*). Conceivably, fish may provide a locally common food source for a visual predator such as *C. lepidus*, although predation on fish has never been documented for this species.

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ELAPHE OBSOLETA OBSOLETA (Black Rat Snake). **RESPONSE TO FIRE.** Immediate and long-term effects of fire on snakes are not well known, although many snakes evolved in fire-maintained habitats, and prescribed burning is widely used by wildlife managers. It is generally thought that reptiles burrow to escape fire, but few direct observations have been published. We describe behavior of two radio-telemetered *Elaphe o. obsoleta* in response to a prescribed burn in the Ouachita National Forest, Arkansas, USA.

On 28 March 1993, U.S. Forest Service staff burned 312 ha of mature shortleaf pine (*Pinus echinata*) forest and clearcut regeneration. Two adult female *E. o. obsoleta* (SVL 120 cm and 108 cm) were monitored during the burn. Each snake contained a surgically-implanted temperature-sensitive transmitter.

Snake 1:—Snake 1 was located moving through the regeneration area at 1020 h, with a body temperature of 26.2°C. By 1145 h the snake had traveled 16 m ahead of the advancing fire, into a forested ephemeral drainage. At 1217 h it entered a cavern beneath an unvegetated 6-m slab of rock under trickling water. We began minute-by-minute telemetric monitoring of the snake's body temperature at 1325 h, along with air temperature 1 cm above ground ("surface temperature") near the rock slab. From 1325 h to 1402 h surface temperature rose from 23.8°C to 32.0°C as flames approached within 2 m of the snake's position. By 1520 h surface temperature fell to 19.3°C. From 1325 h to 1520 h the snake's body temperature remained between 15.7°C and 16.9°C, rising to 18.0°C only twice. Body temperature thus remained cool and constant despite the rise in surface temperature.

Snake 1 was subsequently tracked for 14 months and behaved normally. Radiotracking data showed no evidence of attraction or aversion to the burned area. Snake 1 was located within the burned area 17 of 26 times (65.4%) in 1993 after the fire, while in 1992 (before the fire) it was found in this area 23 of 31 times (74.2%) ($X^2 = 0.19$, df = 1, $P = 0.66$).

Snake 2:—Snake 2 was located at 1115 h in pine forest 500 m from Snake 1. Topography was level, with no drainages within 100 m. Body temperature was 26.0°C; surface temperature was 25.4°C. The snake was entering a log it had occupied as a retreat site on multiple previous occasions. One hour after the fire, the log was found destroyed, but the snake was located underground 13.5 m away, in root caverns of a charred stump. Its body temperature stayed between 10.7°C and 13.3°C from 1628 h to 1657 h. Surface temperature at 1628 h was 26.4°C. While the snake's

behavior was not observed directly, it apparently moved from a favored retreat site and took refuge in cool insulated caverns.

The snake was still in these caverns on 8 April, had moved to a new site by 11 April, and was found high in a tree cavity on 17 April. On 25 April it was found dead on a road 150 m from the tree, crushed by a vehicle. The snake's movement prior to its death, however, suggested it suffered no harm from the fire.

Snakes are often assumed to survive fire by moving underground, but few published observations confirm this. Jackson (1976. Herpetologica 32:359–361) showed *E. o. spiloides* to be more arboreal than *E. o. obsoleta*, and suggested that in southeastern pine forests lacking rocky caverns they may climb trees to escape fire. Our observations show that in a region featuring both fire-dependent pine forest and rocky soil, *E. o. obsoleta* can find refuge from fire underground.

Fire often benefits vertebrates by improving foraging habitat or increasing prey populations. Mushinsky (1985. Herpetologica 41:333–342) showed that snake populations can benefit from fire. Direct and long-term effects of fire on snakes presumably vary with foraging requirements, shelter-seeking behavior, predation pressure, and nature of the fire (Friend 1993. Biol. Conserv. 65:99–114). Our finding that Snake 1 showed no long-term attraction or aversion to burned areas supports the idea that multiple factors may influence their suitability.

We thank G. Bukenhofer, R. Masters, W. Montague, and K. Smith for critiques of the manuscript. Funding was provided by Ouachita National Forest, Southern Forest Experiment Station, Poteau Ranger District (Ouachita N.F.), and Arkansas Audubon Society Trust. We thank W. Montague and Poteau Ranger District fire crews for their kind cooperation.

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HETERODON PLATIRHINOS (Eastern Hognose Snake). **MORTALITY.** On 2 November 1994 I captured an adult female *Heterodon platirhinos* (66.5 cm TL, 270 g) near Searcy, White County, Arkansas, USA. She contained six firm masses approximately the size and shape of oviductal eggs (ca. 18 x 31 mm) in the posterior part of her body. After capture, I released her into a 7 x 15 m outdoor enclosure containing diverse microhabitats including hibernacula, several other *H. platirhinos*, and toads, *Bufo woodhousii*, for food. The other *Heterodon* were long-term residents of the enclosure where they successfully foraged, reproduced, grew, matured, and overwintered. After emergence from hibernation in early April 1995, the snake with the masses appeared healthy despite the now firmer composition of the masses. However, through spring and early summer 1995, she gradually lost weight, became emaciated, and eventually died on 2 July. Autopsy revealed five firm oviductal eggs (total weight = 35 g) and a hardened intestinal fecal mass (weight = 20 g) anterior to the eggs. The weight of the dead snake was 133 g. Assuming no change in mass of the eggs or fecal mass, she had lost 82 g or 38% of her body weight since capture. The eggs exhibited no gross signs of embryonic development.

Egg retention is the norm in oviparous squamates (Shine 1985. *In* Gans and Billett (eds.), Biology of the Reptilia, Vol. 15, pp. 605–694. Wiley-Interscience, New York); nevertheless, deaths of female snakes associated with abnormal retention of eggs or embryos have been reported (e.g., Fitch 1970. Univ. Kansas Mus. Nat. Hist., Misc. Publ. 52:1–247; Plummer 1992. Copeia 1992:1096–1098). Because the time of capture of the snake (2 November) was at least two months after the latest known time of oviposition for this species (Platt 1969. Univ. Kansas Publ., Mus. Nat. Hist. 18:253–420), the retention of eggs was likely abnormal at the time of capture. She probably did oviposit successfully before capture as the average clutch size for a *H. platirhinos* of her size is 22 eggs (Platt, *op. cit.*). Because the anteriormost hardened fecal mass did not increase in size over a period of eight months after capture and because her body weight gradually decreased until death, probably she did not feed after the time of capture, despite the availability of toads. Was the cessation of feeding related to egg retention? Egg retention may have physically prevented feeding via intestinal blockage as evidenced by the hardened fecal mass—immediately anterior to the eggs—which did not move either posteriorly in the body or relative to the eggs from 2 November 1994 to 2 July 1995. Egg retention also could have suppressed the feeding response as commonly occurs in gravid snakes (Murphy and Campbell 1987. *In* Seigel et al. (eds.), Snakes: Ecology and Evolutionary Biology, Macmillan Publ. Co, New York). Because this evidence is anecdotal and circumstantial, it should be interpreted with caution. Nevertheless, these observations suggest the possibility that abnormal prolonged egg retention in snakes may directly or indirectly interfere with feeding and may become a source of mortality.

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NINIA SEBAE SEBAE (Red Coffee Snake). **REPRODUCTION.** On 1 January 1995, two snake eggs were found 3 km SSW of the Belize Zoo about 0.2 km W of the road intersection at La Democracia (near 17°20'20"N, 88°33'45"W), Belize District, Belize. The eggs were in a small earthen cavity under a log. The white leathery shell of each egg was very clean and no development could be discerned by candeling, indicating they were recently laid. The eggs measured 16 x 9 mm and 18 x 8 mm. After collection they were maintained on moist paper towels at an average temperature of near 25°C until hatching. During incubation the eggs increased in size, measuring 24 x 11 mm and 26 x 10 mm prior to hatching. On 6 March 1995, one egg was opened and a dead *Ninia sebae* removed (UTEP 15964). The snake measured 119 mm in total length. The second egg hatched on 10 March. The snake measured 123 mm in total length and weighed 1.0 g. (UTEP 15991). Incubation periods were at a minimum 65 and 69 days. The eggs were collected in Belize under authority of permit CD/6013/94(41).

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REGINA RIGIDA (Glossy Crayfish Snake). **BEHAVIOR.** On 2 March 1995, a pair of *Regina rigida* were found submerged amongst heavy aquatic vegetation in a shallow portion of a borrow pit. This species is commonly found throughout much of southeastern Georgia in similar habitat, hidden in such vegetation, leaf litter, or mud during the daylight hours (pers. obs.). However, on this occasion these specimens were found actively swimming at 1155 h on a bright sunny day. Upon closer examination, it was found that the smaller individual (male, SVL = 28.7 cm; TL = 37.8 cm) was clearly biting the larger specimen (female, SVL = 35.1 cm; TL = 45.2 cm) about midway down the