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Initial Surveys to Locate Arizona Black Rattlesnakes (*Crotalus viridis cerberus*) In Arizona National Parks and Monuments

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Research Background

The Arizona black rattlesnake *(Crotalus viridis cerberus)* is a near-endemic species of rattlesnake found primarily at higher elevations in Arizona. Its biology has not previously been studied in any detail. Recent genetic analyses found that the species is very different from its parental species, the Western Rattlesnake (*Crotalus viridis*). Supporting this genetic distinction, Arizona Black rattlesnakes are a different color (black as adults) from other rattlesnakes in the old grouping (brown or reddish as adults), and they live at high elevations, whereas the others live mostly at lower elevations. They may actually be a new species of rattlesnake!

Despite the excitement generated by these findings among herpetologists, basic biological information is lacking for most populations of Arizona black rattlesnakes. There have been three studies of the species to date: one near Flagstaff, Arizona; one at Saguaro National Park (in both of these studies, animals were simply captured and measured); and one at Tonto National Monument (here animals were surgically implanted with radio –transmitters).

To remedy the lack of scientific and management information for Arizona black rattlesnakes, in 2004 we initiated surveys in Arizona National Parks within the range of this species. We surveyed at Tonto National Monument ("Tonto") in Gila County, Saguaro National Park East ("Saguaro") in Pima County, and Walnut Canyon National Monument ("Walnut Canyon"), in Coconino County. This study had the following objectives: 1) document the presence of Arizona black rattlesnakes in the parks and determine recapture rates to obtain an estimate of relative population size; 2) locate winter hibernation sites and collect habitat data to be used in the future for predicting other suitable den sites; 3) permanently mark individuals and obtain measurement data; and 4) collect supplemental data on social and defensive behavior, mating period, etc. as animals are observed.

Methods

Surveys. We conducted surveys for Arizona black rattlesnakes at Walnut Canyon, Saguaro, and Tonto during the snakes' expected primary active season from late March to early October. Most of our effort was spent conducting walking surveys- walking systematically through a defined sampling area, searching all reasonable areas within that habitat, and recording rattlesnakes encountered. We used data collected from three previously radio-telemetered Arizona Black rattlesnakes at Tonto to supplement natural history information. We also drew on data previously collected at Saguaro during an inventory project, and older observations from Walnut Canyon.

Snake Capture and Processing. We or park staff captured rattlesnakes with snake tongs, and placed them in specially designed snake holding 5-gallon buckets. From the buckets, we then placed the snakes in special tubes, sexed them, and weighed and measured them. We marked the three bottom rattle segments with paint pens to provide individual color combinations that permitted distance identification of marked rattlesnakes by researchers and park staff (so as not to disturb social functions or other behaviors by handling the snake). For permanent identification of individual rattlesnakes, we injected a small microchip tag into each snake. These tags last for the lifetime of their host animal, and may be scanned at a distance of 12 inches to produce a unique identification code. Each time a rattlesnake was captured, we or park staff scanned it with a PIT tag scanner to verify its identity. We then released the snake near its original capture point.

Results

Detections. In 2004, we conducted 37 surveys at the three parks: 10 surveys at Walnut Canyon, 13 formal surveys at Tonto, and 14 surveys at Saguaro. In addition, we spent about 560 hours radio-tracking other venomous species at Tonto from April to September, thereby significantly increasing our chances of encountering an Arizona black rattlesnake. We found fewer Arizona black rattlesnakes (four in 2004) than we anticipated given our survey efforts. We found a total of four Arizona black rattlesnakes: one adult male at Saguaro, two adult females at Tonto, and one adult female at Walnut Canyon. All snakes were found during walking surveys, opportunistically while radio tracking (at Tonto), or by park staff (at Walnut Canyon). In addition to these individuals, 19 Arizona black rattlesnakes were detected at Saguaro in 2001, three were detected at Tonto in 2003, and one was detected at Walnut Canyon in 2003. None of these snakes were recaptured, so we cannot determine exact population size for the parks. Generally, we estimate the species to be most abundant at Saguaro, less common at Walnut Canyon, and rare at Tonto.

Natural History. We detected Arizona black rattlesnakes from May to August in our surveys and telemetered Arizona black rattlesnakes at Tonto were active from late March to late October. We found four individual hibernation dens for three telemetered adult Arizona black rattlesnakes at Tonto in 2004; one snake used different sites in the 2003-2004 and 2004-2005 hibernation seasons. Each den site appeared to contain only one individual rattlesnake; however it is likely that other animals used the same sites. The hibernation sites selected by telemetered Arizona

black rattlesnakes at Tonto were striking in that all were found in rocky talus (rubble) slope areas. No hibernation sites were found at Saguaro or Walnut Canyon.

One of the Arizona Black rattlesnakes captured at Tonto was a pregnant (gravid) female. We surgically implanted a radio-transmitter in this animal as part of another research project and radio-tracked her for the rest of the season. Her range was very small, as expected for a gravid snake, and covered an area of less than 0.5 km^2 in Deadman Wash. She apparently gave birth in early to mid-August. We presume she had four or five offspring, based on the visual determination of the number of embryos in her body near the time of birth. This snake was almost immobile from July 29 to August 22, in a burrow or under a small boulder in a Christmas cactus patch on the bottom edge of the wash. This area was apparently used as a birthing location and retreat site until the babies' first shedding of their skins (usually 1-2 weeks after birth), and the female apparently stayed with them until this shed cycle was completed. We did not see the babies after they were born, but we did find a shed skin from one of the babies at the birthing burrow.

The second Tonto female was found apparently in courtship with a telemetered male Arizona black rattlesnake on August 22. The male snake reacted protectively toward this female before and after she was captured. When the pair was initially approached, he repeatedly moved toward the technician. When the female was released after processing, the male coiled in a tight circle completely on top of her, a behavior known as "stacking" among rattlesnake biologists. To our knowledge, this behavior has not been seen previously in Arizona black rattlesnakes.

A telemetered Arizona black rattlesnake at Tonto was seen eating a woodrat and later, an ash-throated flycatcher. We also know they eat lizards near Flagstaff, so they may have a varied diet.

Given the paucity of Arizona black rattlesnakes we found during 2004, it is not possible to make broad management recommendations for the species in Arizona National Parks. This species is in special need of conservation in the parks due to its rarity (even knowing that the species may be common in high-elevation areas outside the parks). We encourage future repeated surveys for the species in all three parks, especially at Walnut Canyon, due to the interesting evolutionary questions posed by the apparent geographic overlap there of Arizona Black rattlesnakes with the smaller and lighter-colored Hopi rattlesnakes. We recommend that management actions include measures to protect the rattlesnakes at winter hibernation and summer riparian sites. To our knowledge, there has not been a bite by this species in any of the national parks surveyed. We suggest that any Arizona black rattlesnake perceived as a human safety threat be moved not more than 100 m from its capture point, and always to the same habitat type it came from.

Arizona black rattlesnakes often exhibit an iridescent sheen on their scales, so lastly, we encourage all staff and visitors to take a careful look at these beautiful and rare animals (from a respectable distance of 3-4 feet of course).