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Peer-Edited Note

From Seeds to Scales: an Observation of a Kangaroo Rat (*Dipodomys deserti*) Scavenging a Desert Iguana (*Dipsosaurus dorsalis*)

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Abstract.—**Kangaroo rats (Family Heteromyidae) are primarily granivorous (seed-eating) rodents found in arid environments of western North America. They have, however, been documented to consume insects on occasion, potentially when other resources (such as water or vegetation) are scarce. There are no prior observations of opportunistic feeding on vertebrate carrion. Here, we report an observation of a Desert Kangaroo Rat (*Dipodomys deserti*) feeding on the carcass of a Desert Iguana (*Dipsosaurus dorsalis*) in Yuma, Arizona. Pressures in a rapidly changing environment could have influenced this diet flexibility, and we may continue to see more omnivorous behavior in kangaroo rats and similar species as habitats and climates are altered.**

Key Words.—Diet; foraging; Heteromyidae; omnivore; opportunistic.

Kangaroo rats (Family Heteromyidae) are bipedal, nocturnal rodents that inhabit arid and semi-arid regions of western North America (Genoway and Brown 1993). Kangaroo rats are often considered a keystone species, as many other organisms seek refuge within their complex and abundant burrow systems from the high daytime temperatures above ground (Prugh and Brashares 2012). Kangaroo rats also aid in seed dispersal by scatter-hoarding seeds in small caches (Daly et al. 1992), which can increase plant recruitment (Beck and Vander Wall 2010). Nearly all kangaroo rat species are granivorous (seed-eating), with a few species (notably the Chisel-toothed Kangaroo Rat, *Dipodomys microps*) relying on leaves or other plant material as food sources. Several studies have documented that kangaroo rats may occasionally adopt a more opportunistic diet, however, occasionally scavenging or predating invertebrates (Perkins et al. 1976; Hope and Parmenter 2007).

Analysis of fecal and stomach contents of kangaroo rats have found high rates of infection by parasites that require an intermediate arthropod host, with higher rates of parasitism during dry summer months (Bienek and Klikoff 1974). This suggests that kangaroo rats may switch to a more opportunistic diet if seeds become scarce due to dry conditions. Lab experiments have also documented a potential preference for insects over seeds when presented with both options (Perkins et al. 1976). Desert Kangaroo Rats (*Dipodomys deserti*) have been documented to consume and collect insects attracted to illuminated insect collecting sheets (Rust 1989), while extraction of cheek pouch contents and dissection of stomach contents found that Merriam's Kangaroo Rats (*D. merriami*) and Ord's Kangaroo Rats (*D. ordii*) regularly consume arthropods, with arthropods found in the stomach contents of more than 50% of individuals during the spring (Hope and Parmenter 2007). While other rodents, such as squirrels, have been observed incorporating small vertebrates into their diet due to changing environmental factors (Callahan 1993), this behavior has not been reported in kangaroo rats.

Here, we report on an instance of opportunistic carnivorous scavenging by a Desert Kangaroo Rat in which an individual was found to be scavenging a Desert Iguana (*Dipsosaurus dorsalis*) carcass. The observation occurred while studying Sidewinder Rattlesnakes (*Crotalus cerastes*) and Desert Kangaroo Rats on the Barry M. Goldwater Range West (32.383318, -114.382158) in Yuma, Arizona (USA). At approximately 0105 on 10 July 2022, while using radiotelemetry and hand-tracking to locate a sidewinder rattlesnake, a dead Desert Iguana was found beneath a Creosote Bush (*Larrea tridentata*). Ocular hemorrhaging indicated that the Desert Iguana likely died from a rattlesnake bite. By happenstance, we took photographs of the iguana on Android phone cameras, supplemented by flashlights (https://www.youtube.com/watch?v=BsGFtE_4c54&list=PL9zdAEefMyTAuuoj-DYJGQOpULX2khBH1) providing pre- and post-scavenging images of the event. After moving approximately 7–10 m from the Desert Iguana to continue tracking efforts, we saw a Desert Kangaroo Rat interacting with the dead Desert Iguana. Filming was limited as the flashlights appeared to alter the behavior of the Desert Kangaroo Rat. During the interaction, the Desert Kangaroo Rat was observed biting the head and tail of the Desert Iguana, jumping backward towards its putative burrow system while holding the Desert Iguana in its mouth, and periodically retreating about 15–20 m back toward its burrow for a brief time before returning to interact with the carcass. After a few minutes, we reassessed the state of the carcass and photographed it to document any scavenging (Fig. 1). By comparing the images, it was clear that the kangaroo rat chewed on the lower mandible and the neck and putatively consumed approximately half of the tail.

It is not possible to determine the exact reason why the observed Desert Kangaroo Rat scavenged part of the deceased Desert Iguana. It is noteworthy, however,

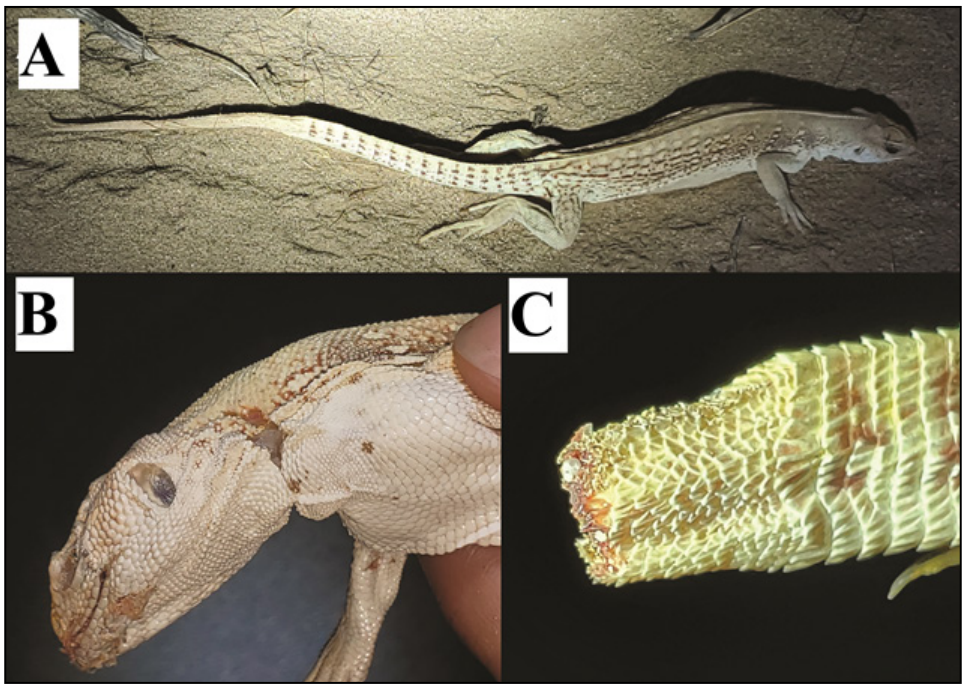

Figure 1. (A) Dorsal view of Desert Iguana (*Diposaurus dorsalis*) pre-kangaroo rat interaction. (B) Post-kangaroo rat scavenging images displaying bite marks on left mandible and neck, and (C) missing (presumably consumed) distal half of tail. (Photographed by Malachi Whitford).

that the population sizes of the kangaroo rats at this site appeared to have decreased substantially between 2022 and 2016, when this site was used for previous research of kangaroo rat and rattlesnake ecology (pers. obs.). Along with fewer kangaroo rats, there appeared to be fewer burrow systems and fewer sidewinder rattlesnakes, resulting in difficulty locating individuals of both species compared to the research efforts in 2016. If the decreased kangaroo rat abundance is driven by food scarcity, this may explain why the kangaroo rat was observed scavenging the Desert Iguana carcass. It is possible that kangaroo rats become more opportunistic (i.e., more carnivorous) as seeds become more difficult to find during particularly hot dry years and/or seasons, which has previously been proposed to explain the increased rate of kangaroo rats infected by parasites that require an intermediate arthropod host during dry years (Bienek and Klikoff 1974). Similarly, this instance of carnivorous scavenging could be driven by food availability as a consequence of decreased primary productivity due to weather pattern changes or habitat degradation, although we are unable to determine if this particular observation of scavenging was a chance interaction or if it represents a broader shift in the population as a whole.

Primary productivity, and therefore seed production, are highly impacted by water availability (Pol et al. 2010). The average rainfall at the nearby Marine Corps Air Station Yuma (MCAS Yuma) in Yuma, Arizona, from 2007 to 2025 was 67.6 mm (2.66 in) per year (http://www.ncei.noaa.gov); however, in the year preceding our observation (the summer of 2021 to the summer of 2022), the average rainfall was only 32.8 mm (1.29 in), a 51.4% drop from the historical average. Additionally, the rainfall leading up to the observation in the same calendar year (1 January to 9 July) was 4.6 mm (0.18 in) in the months preceding the observation compared to 26.7 mm (1.05 in) on average, an 82.9% decrease from the average. In a particularly dry year, such as the year this observation was made, seeds may be scarce, pushing kangaroo rats to seek other sources of nutrition. Alternatively, habitat degradation may also have resulted in reduced forage. The site is actively used by the military and border patrol, where regular anthropogenic disturbance could be a factor in behavioral shifts and/or food availability. Increased construction and off-road driving activity compared to 2016 was noted, possibly associated with the establishment of a staging area for border wall construction near the location of the scavenging observation. Notably, there was damage to burrow systems, as well as annual and perennial vegetation as result of the off-road driving. Future research studying how desert rodents will manage a changing climate and increased habitat disturbance would benefit from examining the occurrence of opportunistic foraging, even in a mostly granivorous rodent.

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Isabella E. Visciglio earned her Bachelor's degree in Environmental Science with an interdisciplinary study in Biology from California State University, Fresno. She currently works with the Fresno Wildlife Rehabilitation Service, rehabilitating and releasing native raptors and mammals back into the wild. Isabella aims to focus her work in the field of wildlife and conservation biology. (Photographed by Isabella Visciglio).

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Alyssa K. Serrano earned her Associate's degree in Life Science from Clovis Community College, where she also completed certificates in Plant Science and Wildlife and Plant Technician studies. In her free time, she volunteers as a docent with the Sierra Foothill Conservancy. Alyssa plans to continue her education at California State University, Northridge, pursuing a degree in Ecology and Evolutionary Biology. Her goal is to build a career in field research. (Photographed by Samuel Serrano).

Grace A. Freymiller is a Biology Instructor at Clovis Community College. She holds a Ph.D. in Evolutionary Biology from San Diego State University, California, and the University of California, Riverside, and a B.S. in Biology (emphasis in Ecology and Biodiversity) from California Polytechnic (Cal Poly) Humboldt. Her research interests generally center around predator-prey and small mammal ecology. Her graduate research focused on the biomechanics and behavioral ecology of kangaroo rat evasive maneuvers during interactions with rattlesnakes. Grace currently teaches Organismal Biology and Field Biology and is working to integrate course-based undergraduate research into her courses to expand research opportunities to community college students. (Photographed by Malachi Whitford).

Malachi D. Whitford is a Professor of Environmental Science at Clovis Community College in Fresno, California. He holds a Ph.D. in Ecology from San Diego State University, California, and the University of California, Davis, and a B.Sc. in Biology with an emphasis in Ecology and Biodiversity from California Polytechnic (Cal Poly) Humboldt. His research focuses on the behavioral ecology of reptiles and small mammals, primarily the interactions between rattlesnakes and kangaroo rats. Malachi teaches a variety of courses related to all aspects of environmental science but focuses on providing students with hands-on field experience. He emphasizes bridging the gap between community colleges and four-year universities by mentoring lower division undergraduate students to obtain research and career technical experience early in their academic careers. (Photographed by Grace Freymiller).