

## OSTEOPHAGY BY THE DESERT TORTOISE (*GOPHERUS AGASSIZII*)

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**ABSTRACT**—The desert tortoise (*Gopherus agassizii*) has undergone significant declines in the past several decades. Thus, many carcasses are present across the desert landscape. Here we report on osteophagy by the desert tortoise, specifically the consumption of bones from deceased desert tortoises. Desert tortoises seem to have an appetite for calcium-rich substances. To our knowledge, this is the first documentation of desert tortoises consuming conspecific skeletal remains.

**RESUMEN**—La población de tortugas del desierto (*Gopherus agassizii*) ha experimentado un decremento significativo en las últimas décadas. Por consiguiente existe un gran número de restos de tortuga en el terreno. Documentamos un fenómeno de osteofagia por parte de las tortugas del desierto, en particular el consumo de huesos de las tortugas muertas. Parece ser que las tortugas del desierto tienen un apetito por sustancias de alto contenido en calcio. Que tengamos conocimiento, ésta es la primera vez que se documenta el consumo de desechos esqueléticos conespecíficos.

The herbivorous diet of the desert tortoise (*Gopherus agassizii*) has been extensively studied (reviewed in Oftedal, 2002), but generally consists of both native and nonnative grasses and forbs, as well as their seeds and fruits. In addition to a variety of plants, the desert tortoise has been observed to consume sand, small rocks, feathers, mammal hairs, snake and lizard skin castings, bones, soil, and arthropods (Hansen et al., 1976; Esque and Peters, 1994), as well as feces of both desert tortoises and other desert herbivores (reviewed in Walde et al., 2006).

Desert tortoise populations in the Mojave Desert have been declining for decades. A result of these population declines is that there are many desert tortoise carcasses across the desert landscape because the bony shells are slow to deteriorate, sometimes lasting longer than 10 y (Woodman and Berry, 1984). Here we report on 3 observations of desert tortoises consuming the bones of deceased desert tortoises. The skeletal remains (i.e., bones only) of turtles and tortoises have commonly been referred to as carcasses whether additional tissues (integument, scutes,

etc.) are present or not. We follow this use of the term carcass to represent any tortoise remains, regardless of material present, age, or condition. On 2 July 2003, in the western Mojave Desert northeast of Barstow, San Bernardino County, California (0818 h, Pacific Standard Time), an adult male desert tortoise was observed eating small pieces of tortoise bone in proximity to a tortoise carcass. He then began moving around the tortoise carcass and aggressively biting and ramming it. He then climbed on top of it, raising his shell (body) high on extended limbs, and then he quickly withdrew his limbs, dropping himself onto the carcass. This caused his plastron to forcibly strike the carapace of the carcass, thereby causing himself to tumble off the carcass. This mounting behavior was repeated several times until one such drop broke off a piece of the carcass bone that was approximately  $1.0 \times 1.5$  cm. The tortoise then ate the piece that it had broken off. From start to finish, the entire observation at the carcass lasted a little over 5 min. The tortoise then walked away, occasionally foraging on *Schismus barbatus* before it entered its burrow, which was 15 m away.

A second observation of a tortoise eating bone from a tortoise carcass was made in late spring 2004 at the same study site. This observation was of an adult female tortoise attempting to consume a piece of a disarticulated tortoise shell. An additional observation of a tortoise eating bone from a tortoise carcass was made 30 May 2005. The tortoise involved was again an adult female, and she was observed to sniff the ground at the area of the disarticulated shell and then consume 3 to 4 small pieces of bone.

Esque and Peters (1994) observed tracks of tortoises around skeletons of numerous animals, including a tortoise skeleton, which led them to believe that tortoises were consuming bones. Further observations during their study in Utah documented osteophagy by the desert tortoise, leading them to conclude that the consumption of bone must be important for mineral supplementation (Esque and Peters, 1994). Murray (1997) reported on an observation of a desert tortoise eating a turkey vulture (*Cathartes aura*) pellet in Arizona and suggested that ingestion of the bones in the pellet might have provided supplemental minerals. Indeed, Sokol (1971) noted that a captive desert tortoise "greedily ate calcareous materials." Oftedal (2002) noted that desert plants have high

calcium content and, therefore, concluded that tortoises in the wild were not likely to be calcium depleted. However, Marlow and Tolstrup (1982) observed desert tortoises consuming soil from exposed lime-layer sites that had higher calcium content than surrounding soils, as well as digging (mining) until they reached a similar layer. Similarly, Stitt and Davis (2003) reported an incidence of suspected caliche mining by 4 juvenile desert tortoises. The sum of these observations suggest that desert tortoises seek out calcium-rich substances for mineral supplementation, which might be indicative of their greater need because they have more bony material (shell). Congeners have also been observed consuming bones (Auffenberg and Weaver, 1969; Anderson and Herrington, 1992; Jackson and Ostertag, 1999).

Some desert tortoise research protocols include the removal of tortoise shells from study areas for later measuring and analysis (Berry, 1984). Our observations of desert tortoises consuming the bones of tortoise shells suggest that removal of these shells from study areas could be depleting an important, limited nutrient resource. Esque and Peters (1994) also cautioned against the removal of tortoise shells during studies and recommended that data collection on tortoise carcasses be completed in the field, and if material is needed for other analysis, only a small piece be removed.

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