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Predation by Badger on Yellow-Bellied Marmot in Colorado

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coast gull arrived at such an unlikely location. A cold front moved down the west coast from British Columbia to southern California on 26 and 27 November 1975. On 28 November, the front, with high winds at 10,000 feet, moved inland over northern Baja California and Arizona. The front moved over Big Lake on 29 November, possibly bringing the gull with it.—*Terry C. Maxwell, Department of Wildlife and Fisheries Sciences, Texas A&M University, College Station, Texas 77843 (current address, Department of Biology, Angelo State University, San Angelo, Texas 76901.)*

PREDATION BY BADGER ON YELLOW-BELLIED MARMOT IN COLORADO.—Badgers (*Taxidea taxus*) prey upon yellow-bellied marmots (*Marmota flaviventris*) (Bailey, North Amer. Fauna 55: 162, 1936; Verbeek, J. Mamm. 46: 506, 1965), although the extent and influence of such predation is unknown. The following account illustrates variation in vulnerability of marmots to badger predation, possibly resulting from differences in physical characteristics of marmot burrows.

On 8 July 1974, while conducting research on yellow-bellied marmots in North Pole Basin, 3380 m, Gunnison County, Colorado, we noted the persistent chirping (alarm whistling) of a single adult female marmot stationed at one of the two entrances to her burrow. After she had called for 10 min, we sighted a badger (1922 hrs MDT) moving into our study area. Although the badger did not approach the female's burrow, it passed within 20 m of it, and was undoubtedly aware of its location, and of the marmot which had by then fled inside it. The badger maintained a generally straight route through the study area, momentarily changing direction or pausing briefly upon encountering burrows. In one instance, it entered a burrow, but reappeared seconds later and continued downvalley. The burrow entered had at least two entrances located among fractures in exposed bedrock, and was the home burrow of an adult female that had entered an hour earlier.

At 1932 hrs, the badger, now 300 m from the point where first sighted, emerged from thick willows and krummholz, moved downslope about 5 m to the base of a rock buttress, and almost immediately began digging. The quick initiation of digging and frequent pauses thereafter agree with observations by Verbeek (*op. cit.*) of a badger preying on a marmot in Wyoming. Digging ceased after 25 min, but the badger remained inside another 40 min; then it emerged and resumed its downvalley course. Darkness limited our examination of the burrow area immediately after the badger's departure. The next morning we found the carcass of a yearling marmot in the burrow at a depth of 1.5 m, at which point the burrow either turned sharply or more likely, ended. All legs, most of the ventral hair, and the postcranial musculature, viscera, and skeleton (except for the first few cervical and caudal vertebrae were absent. The general condition of the carcass and especially the completely intact head led us to conclude the marmot was killed and eaten by the badger. The burrow itself contained a single dirt-floored entrance.

While the study area at times contained 50 or more marmots, during the five months of intensive observation we saw no other instance of predation by any carnivore.

Both the availability and quality of burrows may limit the reproductive success of individual marmots living at high elevations (Andersen, Armitage and Hoffmann, *Ecology*, 57: 552, 1976). One measure of quality would be differential vul-

nerability to digging predators. Hence predation, even if infrequent, could be a selective force modifying marmot behavior associated with recognizing, securing and defending burrow sites. Svendsen (Southwest. Nat. 20: 487, 1976) dissected five burrows at mid-elevation sites close to our study area, and found them to share the same general configuration, including rocks at both the entrance and along the burrow passageway. Most of the burrows in our study area had openings circumscribed by rock. Such entrances prevent expansion of the opening by potential predators such as badgers. In the absence of these entrances, subsurface barriers or escape routes through alternate openings become necessary. Such features were characteristic of most of the remaining burrows within the study area, and their absence, in all likelihood, contributed to the predation described here.

Given that most marmot burrow systems contain features to thwart predators, energetically expensive pursuits into them at every opportunity would be a selective disadvantage, especially to digging predators. This may explain the behavior of the badger to the alarm-calling female marmot. Indeed, Barash (Amer. Midl. Nat. 94: 468, 1975) has suggested marmots alarmed to a predator's presence are generally relatively immune to predation themselves. Most marmots were in their burrows at the time of the badger's appearance and the yearling killed probably was not aware of the predator's presence prior to his initiation of digging at the burrow entrance.

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THE DESERT SHREW, *NOTIOSOREX CRAWFORDI* (COUES), FROM NORTHWESTERN COLORADO.—On 5 August 1975 we captured in a can pitfall trap an adult male *Notiosorex crawfordi* (Fort Collins Collection, U.S. Fish and Wildlife Serv. No. 1374) 6.4 km N of Rifle, Garfield Co., Colorado, elevation 1707 m. This locality, 257.5 km NW of the localities listed by Armstrong (Monog. Mus. Nat. Hist., Univ. Kansas 3:53–54, 1972), represents the northernmost record for *Notiosorex* in North America. Distributional and ecological knowledge of *Notiosorex* has been summarized by Armstrong and Jones (Mammalian Species 17:1–5, 1972).

External measurements (in mm) are: total length, 82.6; tail, 27.3; hind foot, 11.0; and ear, 9.0. Selected cranial measurements (in mm) are: condylobasal length, 16.2; greatest length of skull, 17.0; cranial breadth, 8.2; interorbital breadth, 3.7; maxillary breadth, 4.9; length of maxillary toothrow, 5.9; and mandibular length, 8.0.

Xeric conditions similar to those at Rifle (e.g., sandstone rimrock and sandy arroyo bottoms supporting *Juniperus*, *Artemisia*, *Sarcobatus*, *Ephedra*, *Oryzopsis* and *Bromus*) exist around Rangely, Colorado, at 1615 m elevation. *Notiosorex* might occur near Rangely as well as in the Colorado and Green River Valleys of eastern Utah.

The mesic-boreal conditions of the Roan Plateau and the White River Plateau form a probable ecological barrier to the spread of the desert shrew north of the Colorado River drainage in Colorado. However, a 2278 m pass north of Rifle could