

## PRONGHORN HYPERSENSITIVITY TO AVIAN SCAVENGERS FOLLOWING GOLDEN EAGLE PREDATION

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In the high-elevation deserts of western Wyoming, a facultative scavenger, the Common Raven (*Corvus corax*), and an avian predator, the Golden Eagle (*Aquila chrysaetos*), are sympatric with pronghorn (*Antilocapra americana*). Here we report encounters between these 3 species during winter, when pronghorn responded with extreme anti-predatory behavior.

While conducting ecological surveys of pronghorn on 23 January 2003 in the Green River basin of western Wyoming, we noticed a Golden Eagle atop a sagebrush (*Artemisia tridentata*) plant near an exceptionally large group of pronghorn ( $N = 775$ ). Upon carefully approaching the sagebrush plant, we discovered a dead young female pronghorn (27 kg) in snow 8–10 cm deep. We examined the carcass and found the body still warm and twitching, with blood emanating from it. Our necropsy revealed fractured cervical vertebrae and deep puncture wounds from the talons of an eagle on the back of the pronghorn's neck. Because the fractured cervical vertebrae were under the puncture wounds from the talons, and no legs were broken or showed signs of injury, it is unlikely that the pronghorn fell while running, resulting in the fracture. Necropsy also revealed wounds that had hemorrhaged beneath the skin in the area of the punctures from the talons. All ribs were intact and no meat was removed from them. Canid teeth marks were not observed on any of the bones, nor were there any canid tracks in the adjacent region. No other visible marks were documented on the carcass other than feeding marks made by the Golden Eagle on the posterior end of the carcass. Investigation of the scene surrounding the carcass revealed the presence of bloodstained eagle tracks in the

snow. There were no other prints. Thus, we concluded that the cause of death was Golden Eagle predation.

On 28 January 2003, USDI-BLM biologists observed a Golden Eagle predation event on a pronghorn within 8 km (5 miles) of the site of our predation event (John Dahlke, wildlife biologist subcontracted by BLM, Pinedale, WY, personal communication). Similarly, other researchers have documented predation of pronghorn by Golden Eagles (Lehti 1947, Burns 1970, Goodwin 1976, Barrett 1978, Beale 1978, Bodie 1978, Von Gunten 1978, Autenrieth 1980, Deblinger and Alldredge 1996). Most reported observations of Golden Eagle attacks on pronghorn involve newborn fawns in the spring and summer, although Deblinger and Alldredge (1996) reported 6 incidents of eagle predation on pronghorn in winter (November–February). In each of these reported attacks of eagles on pronghorn in winter, group sizes ranged from 120 to 350 pronghorn. The pronghorn carcass we investigated lay in the middle of a swath of fresh pronghorn tracks >100 m in width, suggesting that the pronghorn had likely been taken from a large group at the time of its death. Because the carcass we investigated was still very warm and little feeding had taken place, we estimated that the pronghorn had been dead for <20 minutes.

The group of 775 pronghorn we observed was within 200 m of the carcass. In nearly 1000 hours of observing 968 groups of pronghorn in the upper Green River basin during 2002–2003, we never observed a group >250 individuals. While we observed the hypervigilant pronghorn, we documented 6 incidents within 5 minutes in which ravens arriving on the scene flew over the group of pronghorn at

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heights between 5 m and 25 m. In each case the pronghorn began to run. In 2 cases the ravens vocalized above the group of pronghorn. Following the 6th pass by a raven, in which the raven vocalized, the pronghorn began to run at top speed in a single-file line through the snow in a 5.6-km (3.5-mile) straight-line sprint. At one point the single-file line of 775 pronghorn was over 1.6 km (1 mile) in length. We documented the time of latency to 1st foraging bite (LTFB) as 52 minutes for the group of pronghorn following this sprint (LTFB was defined as 10% of the group beginning to browse). Following our sampling of the pronghorn, we returned to the site of the carcass; within 1 hour we documented 3 Golden Eagles, 1 Bald Eagle (*Haliaeetus leucocephalus*), 6 Black-billed Magpies (*Pica pica*), and 4 Common Ravens on the carcass.

Hypersensitive reactions by prey species to the presence of predators following the death of a member of the group has been reported for a diverse array of species: e.g., Jackass Penguins (*Spheniscus demersus*; Randall and Randall 1990), ground squirrels (*Spermophilus elegans*; Pfeifer 1980), and crows (*Corvus brachyrhynchos hesperis*; Hauser and Caffrey 1994), but not for ungulates. Additionally, hypersensitive reactions to the presence of predators that actually represent a very marginal danger to the prey species have been reported: e.g., ringtailed lemur (*Lemur catta*) and Verreaux's sifaka (*Propithecus verreauxi*) in Madagascar (Goodman 1994). In these cases the adverse responses of these species to present-day hawks and kites, which are not large enough to pose as serious a threat as an extinct species of eagle did, seem maladaptive (Goodman 1994, Csermely 1996). Responses of an ungulate species to avian scavengers have been previously noted for desert bighorn sheep (*Ovis canadensis nelsoni*; Stockwell 1991). However, mass hysteria and hypersensitivity by an ungulate species in response to the presence of a scavenger species, such as ravens, have not been reported previously in the literature.

Why might ungulates, and specifically pronghorn, respond to avian scavengers? Stockwell (1991) posed 2 possibilities: (1) avian scavengers can be predators on neonates of several ungulate species (Gilbert 1919, Lehti 1947, Larsen and Deitrich 1970, Schaller 1972), and (2) ungulates may be unable to distinguish be-

tween avian scavengers and predators, such as Golden Eagles. Stockwell (1991) concluded that in order to distinguish between these 2 alternatives, additional data needed to be collected.

Why might pronghorn respond in a hypersensitive manner and display an extreme flight response in the presence of an avian scavenger when fawns, which are vulnerable to predation by scavengers, are not present in winter? The data presented here seem to suggest that pronghorn were unable to discriminate between avian scavengers and predators and that the extreme grouping behavior and hypersensitive responses of pronghorn may be a maladaptive by-product of a generalized anti-predator response to large avian predators. Golden Eagles and ravens are often seen together in western Wyoming, and perhaps under duress, pronghorn may associate ravens with the real danger posed by eagles. Extreme responses to a nonthreatening scavenger, such as the 5.6-km all-out sprint brought on by ravens described here, could have serious energetic costs for overwinter survival, especially in regions such as western Wyoming, where temperatures are frequently  $-29^{\circ}\text{C}$  or lower. It is possible that pronghorn hypersensitivity to the ravens was an indirect effect of the recently witnessed predation event, and thus they would respond to any stimulus in such a manner. However, given that the pronghorn did not respond to our vehicle or to us during the  $>50$  minutes we observed the group discounts this idea. It seems more plausible that pronghorn were unable to distinguish between avian scavengers and predators. This inability to discern true danger posed by an avian predator from the very marginal danger of a scavenger would likely have energetic repercussions for pronghorn.

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