



## SPECIAL ISSUE: PREDATION

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# Livestock Depredations by Black Vultures and Golden Eagles

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## Black Vulture Biology

### Black Vulture

There are two species of vultures common in North America, the turkey vulture (*Cathartes aura*) and black vulture (*Coragyps atratus*). In many localities in the United States, vultures are called "buzzards." The turkey vulture specializes in locating and eating carrion. Black vultures also subsist principally on carrion, but at times this species is predatory. Thus, for livestock producers, the black vulture is the species of concern.

Black vultures have a 1.3 to 1.5 m wing span and weigh about 2 kg (Peterson, 1980; Avery unpub. data). Adult and juvenile black vultures have a dark grey head, black body, the underside of the wings are dark grey to black with a white patch at the end of each wing, and a relatively short tail feathers (Peterson, 1980). In flight, black vultures have the appearance of large bats. Black vultures have been reported to live to 25 years of age (Henny, 1990).

The mode of flight differs between black and turkey vultures due to different wing lengths supporting about the same body mass (Rabenold and Decker, 1989). Turkey vultures flap the wings a few times and glide when at low altitudes, whereas black vultures flap frequently interspersed with brief glides when at low altitudes unless a strong wind blows. At high altitudes both vultures fly primarily by gliding and riding thermal wind currents. While soaring or gliding, turkey vultures generally hold their wings at a steeper angle than do black vultures.

The range of the black vulture

includes south-central Arizona, the southern and eastern two-thirds of Texas, and the entire southeastern United States north to the southern portions of Missouri, Illinois, Indiana, Ohio, Pennsylvania, Connecticut and New York (Buckley, 1999). The species' distribution has expanded to the north and east in recent years (Rabenold and Decker, 1989), and the black vulture population on trend is increasing, as measured by the annual Breeding Bird Survey (Sauer et al., vers. 20031).

The black vulture has a very broad diet (Buckley, 1999). Unlike most other vultures, it will subdue, capture and eat live prey, including birds (Baynard, 1909), skunks and opossums (McIhenny, 1939; Dickerson, 1983), turtle hatchlings (Mrosovsky, 1971) and fish (Jackson et al., 1978), and livestock (Lowney, 1999).

The black vulture does not depend upon olfaction to find food (Stager, 1964). Instead, it frequently locates food by sight, sometimes cueing on behavior of turkey vultures (Buckley, 1996). When a turkey vulture finds a carcass, black vultures often arrive in large numbers and dominate or displace the turkey vulture at the feeding site (Stewart, 1978; personal observations). Black vultures roost communally and appear to have a well-developed social structure with long-term, family-based relationships (Rabenold, 1986). Communal vulture roosts probably are important to efficient foraging by black vultures in that information regarding the locations of food resources can be transferred among birds roosting together (Buckley, 1996).

### Golden Eagle

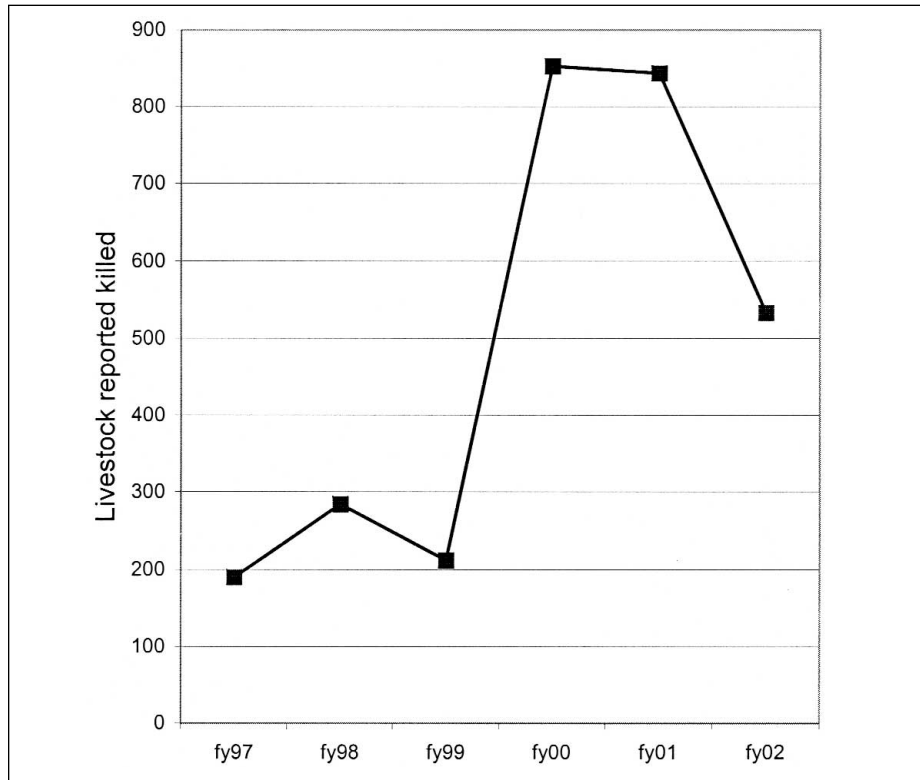
The golden eagle (*Aquila chrysaetos*) is North America's largest predatory bird. Its length averages 75 to 100 cm, wingspan is from 2.2 to 2.5 m and weighs

between 4 to 6 kg. Males and females are similar in appearance, except the female is much larger than the male. Adult plumage, gained at 4 to 6 years, is largely brown, darkening nearer the wings. The tail is grayish brown. The feathers at the head and nape of adult birds are a golden brown (Reilly, 1968; Terres, 1980). It is federally protected under the Bald Eagle Protection Act of 1962. Breeding populations in states, such as California, Colorado, Wyoming and Montana, indicate positive growth ((USG Sauer et al., vers. 20032).

Golden eagles are skilled and efficient predators. Their diet comprises primarily small mammals such as cottontail rabbits (*Sylvilagus spp.*), black-tailed jackrabbits (*Lepus californicus*), rock squirrels (*Spermophilus variegates*), greater sage grouse (*Centrocercus urophasianus*), and other small birds and reptiles. However, golden eagles have been documented taking larger prey, such as mule deer (*Odocoileus hemionus*), pronghorn (*Antilocapra americana*), coyotes (*Canis latrans*), and domestic calves and sheep (Arnold, 1954; McEneaney and Jenkins, 1983; Phillips et al., 1996). They have also been observed eating carrion (R. Phillips, personal communication). One bird can carry up to 8 kg (17 pounds) in flight (Terres, 1980).

Golden eagles mate for life, and a pair may need up to 35 square miles of territory in which to hunt. Breeding season generally begins in mid-January and continues into mid-September, though it can vary according to geographic region. Nests have measured up to 3 m across and 1 m deep and pairs may have multiple nests with their territory. The female is responsible for most of the incubation and will lay 1 to 4 eggs. Incubation lasts about 35 to 45 days, and nestlings fledge at 9 to 12 weeks (Terres, 1980).

**Figure 1. Reports of black vulture attacks to livestock have increased in recent years.**



## Livestock Depredations

### Black Vulture

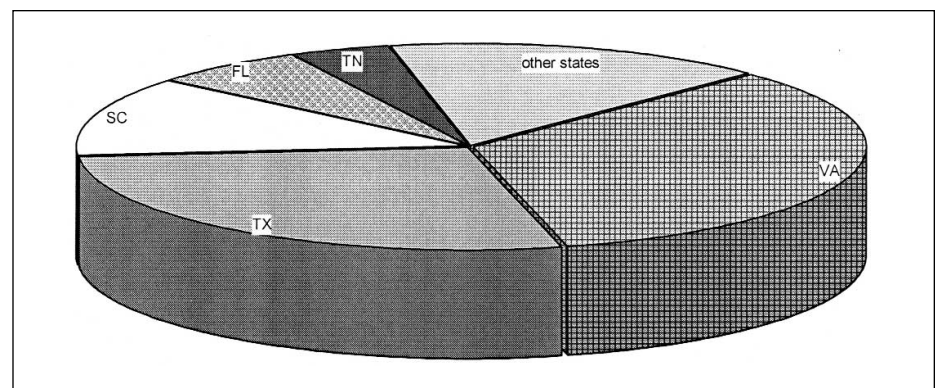
The black vulture's dietary breadth, social behavior and foraging skills contribute to its role as a problem species for many livestock producers. Damage by black vultures to livestock and poultry has been reported for decades (e.g. Roads, 1936; Sprunt, 1946; Lovell, 1947). In Florida, Baynard (1909) stated that "Hundreds of young pigs, lambs, etc., are annually devoured by them... I have had them come into my yard and catch young chickens."

There is no doubt that black vultures continue to attack, kill, and eat domestic animals, but at this time there is little information on the frequency and extent of such occurrences. Data compiled by the USDA's Wildlife Services Program suggest an increasing trend in the numbers of domestic animals attacked by black vultures since 1997 (Fig. 1). These data are compiled from reports to USDA Wildlife Services personnel. We do not know what proportion of the total number of depredations is reported, so at best these data might represent minimal estimates of the extent of the vulture damage problem.

Alternatively, these data might overestimate actual vulture-caused mortality because some of the deaths attributed to black vultures could have been due to other factors.

During 1997 to 2002, reports of depredations on domestic animals by black vultures were received from 18 states. Virginia, Florida, Texas, South Carolina, and Tennessee accounted for 84% of the reported incidents (Fig. 2). Depredations to cattle were reported from each of the 18 states, and overall more than half of the livestock depredation reports involved cattle (Fig. 3).

**Figure 2. Although 18 states have reported depredations to livestock by black vultures, most reports come from Texas, Virginia, Florida, Tennessee, and South Carolina.**



Overwhelmingly, black vulture damage to livestock was to young animals (Fig. 4). This apparent preference for young animals is consistent with the birds' ability to identify and then subdue weak and vulnerable individuals.

In Virginia, 115 incidents of black vulture interactions with 1037 livestock animals were recorded during 1990-1996 (Lowney, 1999). Vultures disabled young lambs and calves by first pecking out their eyes and then attacking vulnerable soft parts (rectum, genitals, nose). Cows giving birth were attacked in a similar manner. The prey animals were attacked by groups of 20 to 60 vultures.

At a cattle ranch in central Florida, our investigations showed that both black and turkey vultures focused their activities in pastures where active calving was occurring. Both species of vulture were frequently observed feeding on afterbirth as well as on fresh droppings from calves. At this ranch, we also observed two depredation incidents, four months apart, and one attempted depredation. In each depredation event, the calf was dead and the heifer was alive. There were 20 to 40 black vultures feeding on the dead calves and attacking the heifers when we arrived. Possibly, the calves were stillborn, but it is also possible that black vultures killed them. Each of the heifers was unable to stand and each was euthanized by the rancher because of injuries inflicted by the vultures. During the attempted depredation, we videotaped three black vultures as they repeatedly pecked at the hooves of a calf as it was being born. This cow was able to get up and chase the birds off, however, and she later gave birth without incident.

## Golden Eagle

Golden eagle predation on livestock has been documented in many areas of the western United States. Most depredations involve golden eagles preying on young lambs and goats; depredations on domestic calves occur occasionally. A eagle damage survey (Phillips and Blom, 1988) suggested that, in many cases, resident golden eagles were responsible for chronic losses of young domestic lambs (*Ovis aries*), particularly in parts of Colorado, Wyoming, Montana and Utah, where relatively dense breeding eagle populations overlap with lambing areas (Boeker, 1974).

Serious golden eagle depredations in the United States are usually infrequent and localized (Matchett and O'Gara, 1991). The most severe problems are acute, short-term conflicts during lambing and kidding periods. Most researchers have found low levels of golden eagle depredation on livestock (McGahan, 1967; Bolen, 1975; Olen-droff, 1976).

Most depredation complaints involve eagles preying on young lambs and goats (Fig. 5; U.S. Dep. Agric. 1991). In 1999, 10,700 head of sheep and lambs were preyed on by golden eagles, representing about 4% of overall predation losses at a cost of \$522,000 (National Agriculture Statistical Service 2000). In Wyoming, of 3,600 lamb carcasses examined, 878 were killed by predators (Tigner and Larson, 1977; 1981); 70 had been killed by golden eagles and another 19 were suspected eagle kills. Foster and Crisler (1978, 1979), found golden eagles responsible for up to 15 percent of the lamb losses they examined in the late 1970s in Oregon's Hells Canyon National Recreation Area. During the same period, the Wyoming wool growers estimated losses at 8,600 lambs or \$500,000 (Matchett and O'Gara, 1991). In addition, a survey conducted from 1997 to 2002 by Wyoming Agriculture and presented in the Wyoming Agriculture Statistics, indicated that eagles, specifically golden eagles, took over 40,000 sheep/lambs during this period. In Texas, U.S. Department of Agriculture's Wildlife Services verified 98 sheep/lambs taken by golden eagles from 1995 to 2003 (M. Rendon, USDA, Wildlife Services, Management Information System, November 2003).

Figure 3. Of the reported black vulture depredation incidents, 52% have involved cattle.

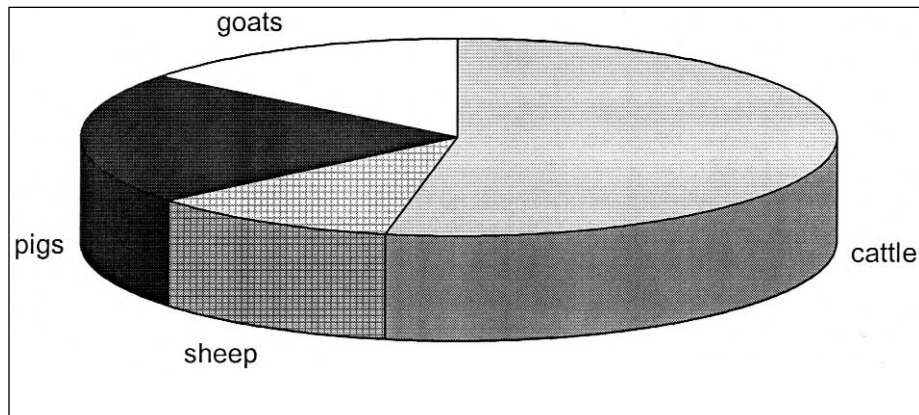


Figure 4. Black vultures overwhelmingly prey on young animals.

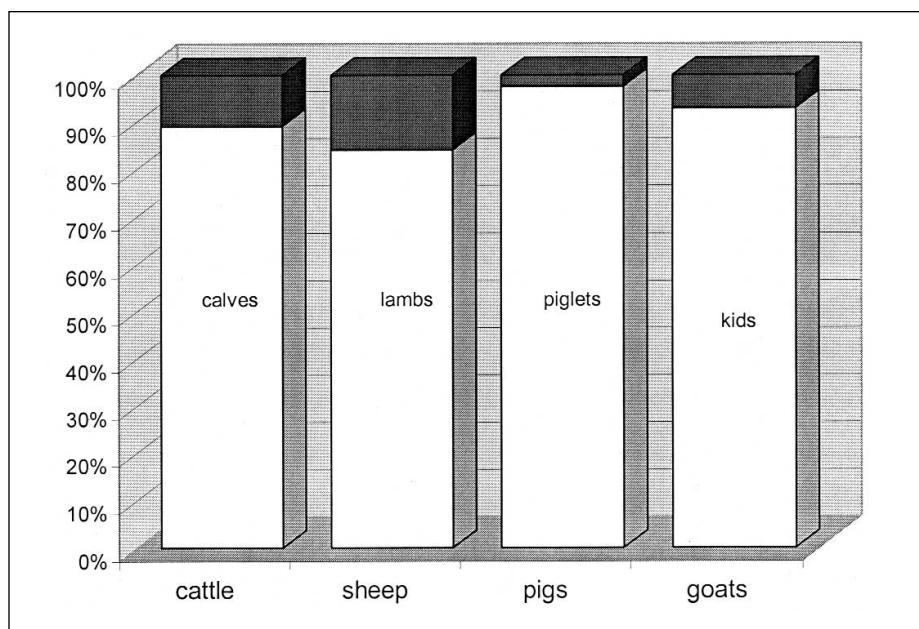
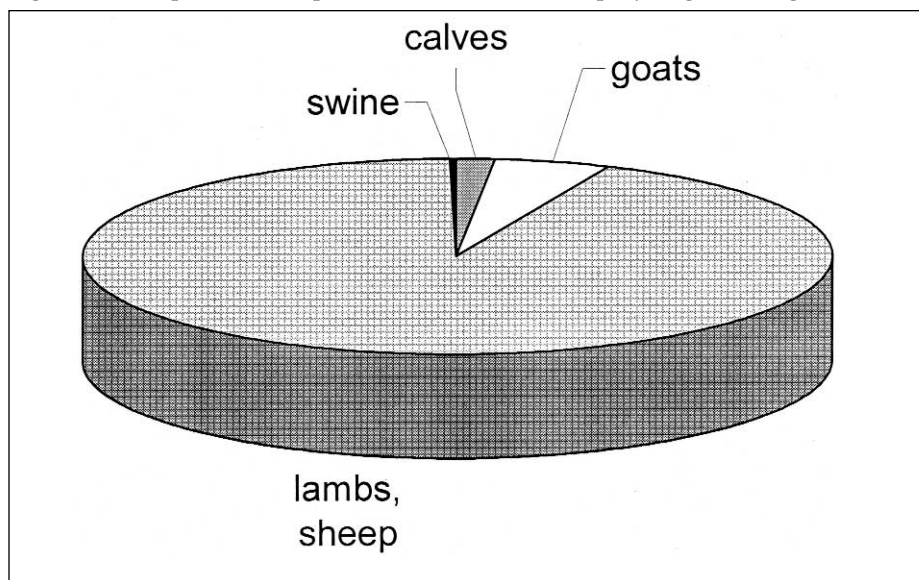


Figure 5. Sheep and lambs predominate as livestock prey of golden eagles.



Depredations on domestic calves occur occasionally. Wood's (1946) observed a golden eagle killing a calf. The most severe calf depredation by golden eagles occurred on the Tigner Ranch in New Mexico, where eagles killed 12 calves and injured 61 between 1987 and 1989. Calves weighed between 41 to 114 kg and represented a \$20,000 loss (Phillips et al., 1996).

## Vulture Management Methods

### Black Vulture

**Harassment.** Reportedly, vultures can be dispersed from pastures by firing .22 caliber or larger rifle ammunition near loafing vultures. Pyrotechnics or shotguns can also be used. Such harassment often has short-term benefit only, as vultures will return to the site within a few hours. It is illegal to kill or wound a vulture without a Migratory Bird Depredation permit issued by the U.S. Fish and Wildlife Service (USFWS).

**Cultural.** Removal of food sources, such as dead livestock and road-killed animals, reduces food availability and could lessen the likelihood of vultures being attracted to an area. Vulture depredations can be prevented by locating lambing, pigging, and calving activities in sheds or buildings, or by using paddocks close to barns or buildings with human activity so that birthing animals can be monitored closely.

**Effigies.** Dispersal of vulture roosts near a livestock operation can help reduce the likelihood that depredations will occur (Tillman et al., 2002; W. Bonwell, personal communication). Dispersal is often best accomplished by suspending a vulture carcass or a taxidermic effigy of a vulture in the roost, but other roost dispersal options, such as pyrotechnics, could produce a similar result. The advantage of using the effigy method is that the vultures will not return once they are dispersed. As long as the effigy remains in place the roost will not reform.

At this time, we do not know the fate of vultures that formerly occupied a dispersed roost site. They must occupy alternate roost sites, but definitive studies on where they go and what they do subsequently have yet to be done.

**Trapping, relocating.** Vultures are

readily trapped in large, baited, walk-in pens (Parmalee and Parmalee, 1967; Davis, 1998; Humphrey et al., 2000). The benefits of relocating trapped vultures are dubious, however. In Texas, relocating trapped birds did not reduce problems at industrial facilities where the birds were trapped. Furthermore, there were increased complaints regarding vultures at the release sites (Davis, 1988). In Florida, four of eight transmitter-equipped vultures released >250 km from the trap site eventually were tracked to within 16 km of their original roost (Humphrey et al., 2000). It was concluded that unless trapping and relocation are combined with habitat modification and harassment to render the original site less attractive to vultures, problems at the original site will persist. At this time there is no evidence that trapping and relocation is an effective vulture management tool.

**Lethal control.** Given increasing population trends for the black vulture (Sauer et al., *vers.* 20013), selective lethal control would appear to have limited potential for impacting the overall health and viability of the species. Selective removal of problem vultures could, however, potentially contribute to resolving local vulture management conflicts. Additional documentation of the effectiveness of selective, direct lethal control for vulture management is needed as is quantification of the assertion that removal of a few vultures from a local population increases the efficacy of harassment programs and prevents habituation to harassment (Kadlec, 1968). A Migratory Bird Depredation Permit issued by the USFWS is required before vultures can be killed.

### Golden Eagle

Depredation management techniques for golden eagles include trapping and relocation, harassment, alarm/distress calls, and human-like scarecrows. Relocation of non-breeding and breeding golden eagles from lambing or calving grounds offers only a short-term solution. Scarecrows combined with harassment and increased human activity has proved to be the best lamb protection with minimal expense.

**Trapping, relocation.** Two research studies evaluating the response of golden eagles to trapping and relocation showed that of 14 resident golden eagles relo-

cated over 400 km from their capture sites in Wyoming, 12 returned to their capture sites within 11 to 316 days. Phillips et al. (1991) concluded that relocation of breeding adult golden eagles, at best, offered only a short-term solution to the problem of eagle depredation on livestock. Niemeyer (1975-1983) showed that relocation of 432 golden eagles at a cost of \$112,771 had little demonstrated effect on reducing depredations.

**Scaring, harassment.** Alarm/distress calls and harassment with a helicopter or airplane did not reduce depredations, number of birds present or alter their distribution (O'Gara et al., 1984; Matchett and O'Gara, 1987).

Human-like scarecrows suspended on high knobs and ridges where sheep typically bed for the night seemed to cause golden eagles to avoid those areas. When coupled with harassment (shooting explosive shotgun shells), the effects seemed to be effective in keeping eagles away from lambing bands (O'Gara et al., 1984).

**Lethal control.** Golden eagles are protected under the Migratory Treaty Act and the Bald and Golden Eagle Act. Since the 1990s, no lethal-take permits have been issued by the Director of the U.S. Fish and Wildlife Service (USFWS) in the western United States. However, the USFWS has issued limited permits for trapping golden eagles that are causing livestock depredations. Golden eagles that are trapped are either given to a Native American Indian Tribe, a master falconer, or are relocated.

## Conclusions

### Black Vulture

The available evidence suggests that black vultures act as typical predators by seeking and disabling vulnerable animals prior to overwhelming and killing them (Gluesing et al., 1980). These birds take the path of least resistance and eat carrion when it is available. Black vultures are opportunists, however, and when the chance arises, they will attack and eat defenseless live animals. Defenseless does not necessarily mean sick or injured. Healthy newborn livestock are defenseless, especially if the mother is exhausted or otherwise not able to care for and protect the offspring.

In assessing the role of black vultures as livestock predators, it is difficult to obtain objective, unbiased information because direct observations of black vulture attacks on livestock are uncommon. Usually, the investigator arrives at the feeding site after the prey animal is dead and the chain of events leading to the demise of the animal is speculative. The fact that black vultures are feeding on a carcass is not evidence that the birds killed the animal. Some animals are stillborn and others die for reasons unrelated to black vultures. Female livestock, especially young and inexperienced ones, sometimes suffer mortal injuries while giving birth. If vultures attack and kill such mortally injured animals, they are eliminating individuals that are already doomed.

As the black vulture population increases and its range continues to expand, depredations to livestock are likely to increase. To resolve these conflicts, research is needed to understand more fully the population dynamics of this species and to determine factors that contribute to the birds' preying on livestock. In particular, it will be important to know why some livestock operations incur vulture damage while other ranches are not affected. Research is currently underway specifically to address these data gaps.

### Golden Eagle

Golden eagle populations are increasing in western states with sheep production. It is unknown whether increased eagle numbers translates into increases in livestock depredations. It is important for livestock producers to understand that management techniques for golden eagles are limited. The combination of human-like scarecrows, harassment and increased human activity is the most feasible means of protecting lambing bands from golden eagles. As potential new avian management techniques evolve, an effort should be made to evaluate their effectiveness to reduce livestock depredation from golden eagles.

### Literature Cited

- Arnold, L. W. 1954. The golden eagle and its economic status. Circular 27. U.S. Fish Wildlife Service. Washington D.C.
- Baynard, O. E. 1909. Notes from Florida on *Catharista urubu*. *Oologist* 26:191-193.
- Boeker, E. L. 1974. Status of golden eagle surveys in the western states. *Wildl. Soc. Bull.* 2:46-49.
- Bolen, E. G. 1975. Eagles and sheep: a viewpoint. *J. Range Manage.* 28:11-17.
- Buckley, N. J. 1996. Food finding and the influence of information, local enhancement, and communal roosting on foraging success of North American vultures. *Auk* 113:473-488.
- Buckley, N. J. 1999. Black vulture (*Coragyps atratus*). In *The Birds of North America*, no. 411 (A. Poole and F. Gill, eds.). The Birds of North America, Inc. Philadelphia, PA.
- Davis, E. R., Jr. 1998. Strategies for alleviating vulture damage in industrial plants. *Proc. Vertebr. Pest Conf.* 18:71-73.
- Dickerson, D. D. 1983. Black vultures kill skunk in Mississippi. *Mississippi Kite* 13:2-3.
- Foster, H. A. and R. E. Crisler. 1978 and 1979. Evaluation of golden eagle predation on domestic sheep. Unpubl. Rept. U.S. Fish and Wildlife Service, Portland, Oregon.
- Gluesing, E. A., D. F. Balph, and F. F. Knowlton. 1980. Behavioral patterns of domestic sheep and their relationship to coyote predation. *Appl. Anim. Ethol.* 6:315-330.
- Henny, C.J. 1990. Mortality. pp. 140-151 In *Birds of Prey*. I. Newton, P. Olsen, and T. Pyrzalowski, eds. Facts on File, NY, NY. 240 pp.
- Humphrey, J. S., M. L. Avery, and A. P. McGrane. 2000. Evaluating relocation as a vulture management tool in north Florida. *Proc. Vertebr. Pest Conf.* 19:49-53.
- Jackson, J. A., I. D. Prather, R. N. Connor, and S. P. Gaby. 1978. Fishing behavior of black and turkey vultures. *Wilson Bull.* 90:141-143.
- Kadlec, J.A. 1968. Bird reactions and scaring devices. *Apend.1.Fed.Aviation Advis. Circ.* 150-5200-9.
- Lovell, H.B. 1947. Black vultures kill young pigs in Kentucky. *Auk* 64:131-132
- Lowney, M. S. 1999. Damage by black and turkey vultures in Virginia, 1990-1996. *Wildl. Soc. Bull.* 27:715-719.
- Matchett, M. R. and B. W. O'Gara. 1987. Methods of controlling golden eagle depredations on domestic sheep in southwestern Montana. *J. Raptor Res.* 21:85-94.
- McEneaney, T. P., and M. A. Jenkins. 1983. Bald eagle predation on domestic sheep. *Wilson Bull.* 95:694-695.
- McGahan, J. 1967. Quantified estimates of predation by a golden eagle population. *J. Wildl. Manage.* 31:496-501.
- McIlhenny, E. A. 1939. Feeding habits of the black vulture. *Auk* 56:472-474.
- Mrosovsky, N. 1971. Black vultures attack live turtle hatchlings. *Auk* 88:672-673.
- National Agriculture Statistical Service. 2000. Sheep and goat predator loss. Release May 5, 2000. 1 pp.
- Niemeyer, C. 1975-1983. Montana golden eagle removal and translocation project. Final report. U.S. Fish and Wildlife Service, Billings, Montana.
- O'Gara, B. W., D. Pond and R. L. Phillips. 1984. Evaluation of scarecrows for frightening golden eagles from lambing herds. Unpubl. Rept. Montana Cooperative Wildlife Research Unit. Univ. of Montana, Missoula.
- Olendorff, R. R. 1976. The food habits of North American golden eagles. *Am. Midland Naturalist.* 95:231-236.
- Parmalee, P.W. and B.G. Parmalee. 1967. Results of banding studies of black vultures in eastern North America. *Condor* 69:146-155
- Peterson, R.T. 1980. A field guide to the birds: east of the Rockies. Houghton Mifflin, Boston. 384 p.
- Phillips, R. L. and F. S. Blom. 1988. Distribution and magnitude of eagle/livestock conflicts in the western United States. *Proc. Vertebr. Pest Conf.* 13:241-244.
- Phillips, R. L., J. L. Cummings and J. D. Berry. 1991. Response of breeding golden eagles to relocation. *Wildl. Soc. Bull.* 19:430-434.
- Phillips, R. L., J. L. Cummings, G. Notah and C. Mullis. 1996. Golden eagle predation on domestic calves. *Wildl. Soc. Bull.* 24:468-470.
- Rabenold, P. P. 1986. Family associations in communally roosting black vultures. *Auk* 103:32-41.

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- Rabenold, P. P. and M. D. Decker. 1989. Black and turkey vultures expand their ranges northward. *Eyas* 12:11-15.
- Reilly, E. 1968. The Audubon illustrated handbook of American birds. McGraw-Hill Book Company, New York.
- Roads, K. M. 1936. Black vultures kill and eat new-born lambs. *Wilson Bull.* 48:219.
- Sauer, J. R., J. E. Hines, and J. Fallon. 2003. The North American Breeding Bird Survey, Results and Analysis 1966-2002. Version 2003.21, USGS Patuxent Wildlife Research Center, Laurel, Maryland.
- Sprunt, A. 1946. Predation on living prey by the black vulture. *Auk* 63:260-261.
- Stager, K. E. 1964. The role of olfaction in food location by the turkey vulture (*Cathartes aura*). *Los Angeles County Mus. Contrib. Sci.* No. 81:1-63.
- Stewart, P. A. 1978. Behavioral interactions and niche separation in black and turkey vultures. *Living Bird* 17:79-84.
- Terres, J. 1980. The Audubon society encyclopedia of North American birds. Alfred A. Knopf, New York.
- Tigner, J. R. and G. E. Larson. 1977. Sheep losses on selected ranches in southern Wyoming. *J. Range Manage.* 30:244-252.
- Tigner, J. R. and G. E. Larson. 1981. Golden eagles: scavengers and predators on domestic lambs. In: 1982 Wildlife-Livestock Relationships Symposium. Univ. of Idaho, Moscow.
- Tillman, E. A., J. S. Humphrey and M. L. Avery. 2002. Use of effigies and decoys to reduce vulture damage to property and agriculture. *Proc. Vertebr. Pest Conf.* 20:123-128.
- U.S. Department of Agriculture. 1991. Sheep and goat predator loss. Rep. Livestock General 1 (4-91). Natl. Agric. Stat. Serv. 12pp.
- U.S. Geological Survey. 2002. Golden eagle-North American breeding bird survey trend results. [www.mbr-pwrc.usgs.gov/cgi-bin/atlas02.pl?03490](http://www.mbr-pwrc.usgs.gov/cgi-bin/atlas02.pl?03490).
- Wood, D. T. 1946. Eye-witness account of golden eagle killing a calf. *Condor* 48:143.