Responses of Black Vultures to Roost Dispersal in Radford, Virginia

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ABSTRACT: Depredations to livestock by black vultures are a concern for many producers, and there is an increasing need for effective means to alleviate conflicts between livestock and vultures. One approach to this problem is to identify the roost site that is the source of the offending birds and then disperse that roost. We evaluated this approach in southwestern Virginia, where sheep and cattle operations in the New River Valley have historically experienced depredations by black vultures. During February 2004, we trapped and tagged 200 vultures and equipped 20 of them with radio transmitters. We established data-logger receiving stations at the main roost site in Radford, VA and at 4 nearby livestock operations. We monitored vulture use of the roost and the livestock sites for 2 weeks and then we dispersed the Radford roost using vulture effigies and hand-held lasers. We continued to monitor vulture activity at the livestock study sites for 8 weeks. Our findings showed that although the roost in Radford was dispersed, vulture use of the livestock operations after roost dispersal did not differ from pre-dispersal activity. Vultures in the area apparently shifted to alternate roost sites with no noticeable disruption to their foraging activities. For roost management to be effective against livestock depredations, dispersal activity must include the ancillary roosts as well as the main roost. Furthermore, prompt removal and proper disposal of livestock carcasses should greatly reduce the attractiveness of cattle and sheep operations for foraging black vultures.

KEY WORDS: black vulture, *Coragyps atratus*, livestock, roost dispersal, Virginia

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INTRODUCTION

It is widely reported that black vultures (*Coragyps atratus*) prey on newly born livestock. Since 1991, USDA Wildlife Services personnel have responded to reports of black vulture depredations from 23 states. Although vulture predation on livestock has been recorded for many years (e.g., Roads 1936), there still is relatively little information on this phenomenon. The most thorough documentation is from Lowney (1999), who accumulated data on 115 predation incidents involving over 1,000 animals in Virginia. His work demonstrated that the black vulture was the species of concern; turkey vultures (*Cathartes aura*) were never reported killing or injuring livestock. One aspect of vulture depredation activity that remains unclear is the source of depredating birds. It is suspected that black vultures at a given livestock operation derive from nearby roosts, but this has not been quantified. Such information is important, because if depredating birds can be traced to a specific source roost, then it follows that dispersal of that roost could greatly reduce the depredation pressure at that livestock site (Tillman *et al*. 2002).

The vulture roost in Radford, VA is a fairly recent development. Historically, a large winter roost of turkey and black vultures formed at the Radford Army Ammunition Plant (RAAP), along the New River approximately 8 km from the city of Radford (Prather *et al*. 1976, Sweeney and Fraser 1986). In autumn 2001, however, a tract of pine trees was harvested at the RAAP near where the vultures roosted. That winter, large numbers of vultures started to roost in Radford (L. DiIoia, RAAF, pers. commun.). In this study, we documented use by black vultures of the winter urban roost in Radford, and we documented the presence of vultures in surrounding livestock operations before and after dispersal of the Radford roost. We hypothesized that vulture activity at the livestock operations would decrease after the vultures were dispersed from the Radford roost.

METHODS

Trapping and Marking

We trapped vultures at the RAAP in 2 walk-in traps ($9.3 \times 3.1 \times 1.8$ m) baited with deer carcasses. We trapped at RAAP, which is 7.7 km from the Radford roost site, because there is restricted access, the traps would not be molested there, and previous observations revealed frequent movement of birds between the Radford roost and the RAAP. Between 9 and 17 February 2004, we trapped and tagged 200 black vultures. Birds were marked for visual identification with uniquely coded white cattle ear tags (Allflex, Inc., Dallas, TX) attached to the patagium of the right wing (Wallace *et al*. 1980, Sweeney *et al*. 1985). In addition, 20 birds also received 35-g VHF radio transmitters (model M3530, Advanced Telemetry Systems, Inc., Isanti, MN) that were glued to patagial tags and attached to left wing. We released tagged vultures at the trap site.

Transmitter Data

We established VHF receiving stations (receiver, data logger, and antennas) at the Radford roost and at 4 livestock operations (referred to as Farms D, G, M, and S) with histories of vulture depredation problems located 4.2-22.3 km from the roost. We logged data continuously at the 5 receivers from 13 February until 21 April 2004. At each site, we tested the receiving unit for proper sensitivity and coverage to ensure that transmittered birds visiting the site would be recorded. We determined that signal strength was greatly affected by the hilly terrain in which we were working, so that there was not a consistent relationship between signal strength at the receiver and distance to the transmitter. Thus, because we wanted to document only birds that actually used the study sites, we restricted our analyses to the highest signal strengths. In so doing, we might have eliminated some records of nearby birds that produced low signal strength because of intervening obstructions. But at the same time, we minimized the chance of including birds from off the study site which were detected at long range because of unobstructed signal transmission.

Visual Observations

Except for 16 February, we observed the Radford roost each morning from 11 February to 4 March 2004. During these observations, we continuously recorded the number and species of vulture departing the roost for 2 h, starting approximately 20 min before sunrise. We also recorded vulture activity at each of the livestock sites 3 or 4 times weekly from 13 February to 5 April. During these 1-h observations, which occurred between 1000 and 1500, we recorded all vultures that flew over or perched at the site. In addition, we visited several roost sites in the New River Valley, 5 to 40 km from the Radford roost, in order to record tagged vultures. These observations occurred opportunistically when we received information indicating that tagged vultures were using a particular location.

Roost Dispersal

We initiated dispersal efforts at the Radford roost on the evening of 26 February when we installed vulture effigies and carcasses on 4 trees (Avery *et al*. 2002, Tillman *et al*. 2002). We supplemented effigy use with the application of handheld lasers as needed during the next 3 evenings (Glahn *et al*. 2000). Effigies remained in place until we removed them on 20 April.

RESULTS

Radford Roost Counts

Number of vultures reached a maximum of 925 (423 black, 502 turkey) on 22 February, after which counts declined even before roost dispersal started (Figure 1). We believe that this decline was at least partly due to activities in the roost by a science class from Radford University. The class established a grid with flagging tape beneath the roost trees and recorded birds as they entered the roost in the late afternoon.

Our daily morning roost exit counts before initiation of dispersal averaged 215 black vultures (SE = 35) compared to 7 (SE = 5) after dispersal activities began. After 3 days of harassment, there were no birds in the roost. Periodic checks revealed no additional vulture roosting at this site through 20 April.

Vulture Use of Livestock Operations

We detected no difference ($F_{1,178} = 0.22$; $P = 0.638$) in black vulture activity at livestock operations before and after dispersal of the roost in Radford. Of the 4 sites, the farm closest to the roost was used most by vultures (Figure 2). Vulture activity at this site was concentrated where the owner dumped dead cows.

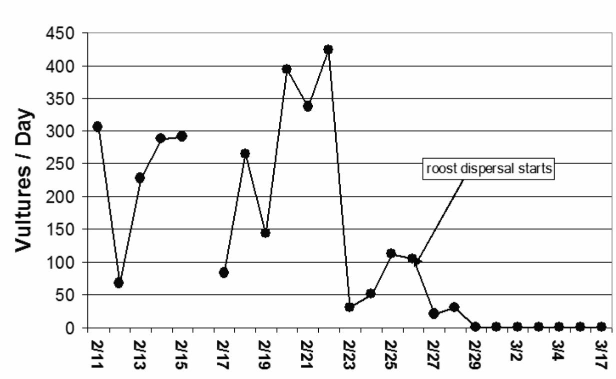

Figure 1. Black vultures counted exiting a communal winter roost in Radford, Virginia. Counts began 20 minutes before sunrise and continued for 2 hours.

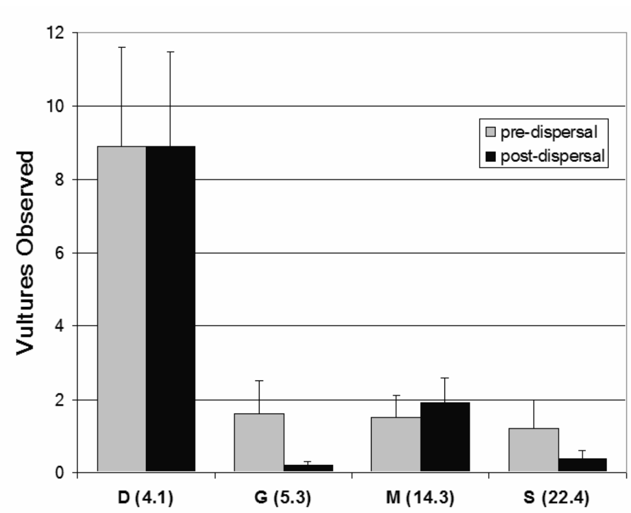

Figure 2. Mean numbers of black vultures observed at 4 livestock farms before and after dispersal of a vulture roost in Radford, Virginia, Feb-Apr 2004. Capped vertical bars denote 1 SE. Distance (km) from the roost to each farm is indicated in parentheses.

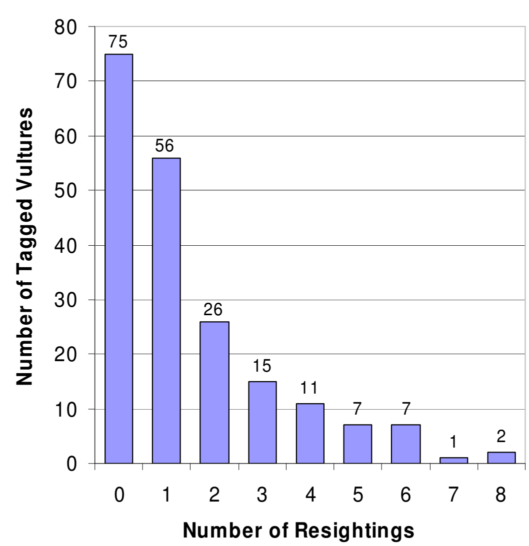

Figure 3. Frequency of tagged vulture re-sightings in the vicinity of Radford, Virginia, during February-April 2004.

Sightings of Tagged Vultures

Of the 200 birds that we tagged and released, 125 (62.5%) were re-sighted at least once (Figure 3). Before dispersal of the roost, 68 tagged vultures (34%) were recorded at Radford which confirmed, as we initially surmised, that the trap site at RAAP did sample the vultures that used the roost at Radford. Tagged vultures were documented from several locations within the New River Valley, as far as 60 km northwest of the Radford roost. We also subsequently received reports of 2 tagged vultures at Upperville, VA, 250 km from Radford. Five birds were recorded at 4 sites and 14 were sighted at 3 sites each.

Tagged birds were seen at each of the livestock operations. Observations at Farm D included 46 individuals and accounted for 63% of all the sightings recorded outside of Radford and the RAAP. Virtually all of the sightings at Farm D were of birds at a carcass dump site on the property. The farmer deposited dead cattle there, and we observed a crowd of vultures whenever we visited the site. A similar situation existed at Farm S, where a carcass dump site was operated 1.5 km from our receiving station and where we observed 4 tagged birds. Single tagged birds were recorded at Farms G and M.

Altogether, we re-sighted 14 of the 20 radio-equipped vultures. We observed 5 radio-equipped birds at Farm D and 5 more at other locations, excluding Radford and the RAAP. The proportion of tagged birds that were radio-equipped did not differ (p = 0.643, X^2 = 0.214, 1 d.f.) between Farm D (5 of 46) and more distant locations (5 of 35).

Radio Telemetry

The signal strength of the 81,271 detections recorded by data loggers at the Radford roost and at 4 livestock operations ranged from 45 to 155. To reduce the chance of using spurious data, we included for analyses only the 7,203 detections (8.9%) with signal strength >129. Also, at this level of signal strength, we never simultaneously recorded a transmitter at 2 receiving stations.

Total detections at the Radford roost decreased from 180.6/day (SE = 50.6; 11 individuals detected) before we initiated roost dispersal activity to 5.7/day (SE = 3.2; 12 individuals) during the post-dispersal period. Daily rates of signals received per bird changed little from pre- to post-dispersal, except at Farm S where no birds were recorded before dispersal of the Radford roost (Figure 4). Numbers of individuals detected decreased with distance from the roost, both before and after roost dispersal (Figure 5). Increased numbers of individuals detected post-dispersal reflects the length of the post-dispersal period (66 days) compared to the pre-dispersal period (13 days).

Two radio-equipped birds were never detected by receiving stations after their release. One of these, however, was visually sighted several times during the course of the study. Of the 18 other birds, each had at least one gap of >3 days during which it went undetected. Some birds were undetected for periods of several weeks (Table 1).

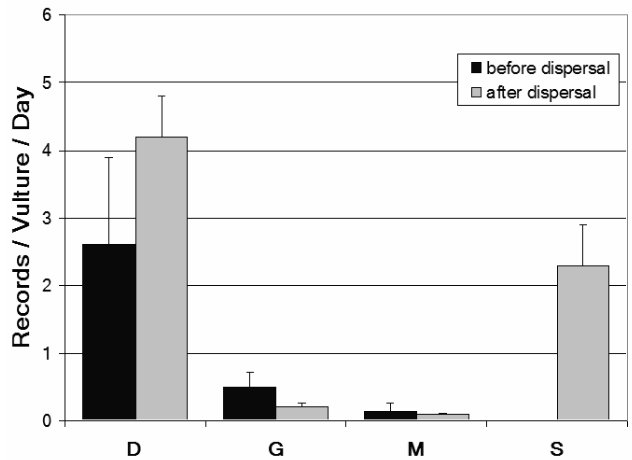

Figure 4. Telemetry records with signal strength >129 logged by receivers at 4 livestock operations in New River Valley, VA before (13 - 26 Feb) and after (27 Feb - 21 Apr) dispersal of the vulture roost in Radford. Capped vertical bars denote 1 SE.

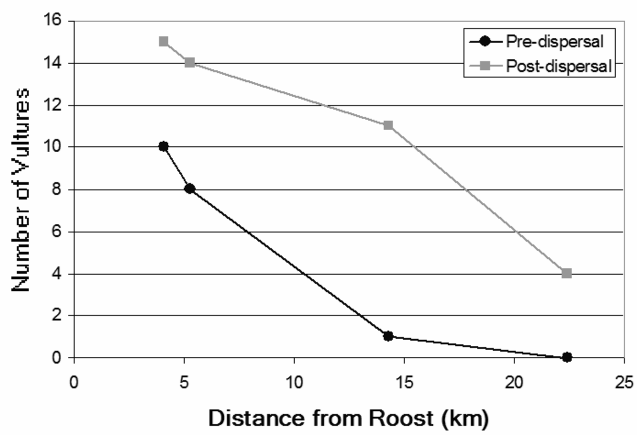

Figure 5. Number of transmittered black vultures (out of 20 possible) detected by automatic data-logging receivers at livestock operations varying distances from the vulture roost in Radford, VA, before (13 - 26 Feb) and after (27 Feb - 21 Apr) dispersal of the roost. Only records with signal strength >129 are included.

DISCUSSION

Dispersal of the roost in Radford did not appear to reduce black vulture activity at nearby livestock operations. The livestock producers stated to us that they did not notice a great deal of vulture activity during the winter of 2004. It is not surprising, therefore, that we did not detect differences in black vulture activity due to the roost dispersal, either with visual observations or with telemetry.

Although the birds that we trapped and tagged at RAAP were part of the vulture population that roosted at Radford, the birds were not restricted to the Radford roost site. Tagged birds were subsequently recorded at several sites within the New River Valley and beyond. This pattern of roosting in which birds move among a number of roost sites has been previously documented in this area

Table 1. Gaps (>3 days) in detections of radio-transmittered black vultures in the vicinity of Radford, Virginia. Birds were tagged on 12 February 2004 and monitored through 21 April. Only detections with signal strength >129 were included in the analysis. Receiving stations were at the Radford roost site (R), and Farms D, G, and M.

Transmitter Frequency	Days to Initial Detection	Location of Initial Detection	Subsequent Detection Gaps (Days)		
			N	$\bar{x}$	SE
1023	2	R	1	38.5	
1099	4	G	4	10.5	4.7
1074	5	G	1	3.5	
1012	6	G	4	9.8	2.3
1049	6	R	3	19.5	5.0
1123	6	R	6	8.5	1.8
1212	6	R	3	16.2	4.6
1234	6	R	2	28.8	16.7
1059	7	R	2	11.5	5.0
1146	7	R	1	56.5	
1113	8	R	4	14.8	7.8
1249	11	R	3	11.0	6.8
1174	12	D	3	10.2	3.5
1157	13	D	3	15.8	5.6
1224	13	D	4	11.8	4.1
1199	28	M	2	18.5	15.0
1186	43	D	1	24.5	
1085	51	G	1	16.5	
All Detection Gaps (18 Birds)			48	14.9	1.7

(Sweeney and Fraser 1986), and the same situation seems to apply to black vultures elsewhere (Rabenold 1987*a*, Stolen 1996). The multi-roost system has important implications for the management of depredations to livestock. If vultures have alternate roost sites available to them in a local area, then dispersing them from a single site will probably not reduce black vulture activity at local livestock operations. Instead it likely will be necessary to disperse birds from several or perhaps all of the roost sites in the local area. The extent to which this is a feasible approach to the management of black vulture depredations will depend on the number of roosts, their accessibility and characteristics, and the degree of site fidelity vultures display toward the sites.

Several birds equipped with transmitters went undetected for extended periods. One explanation for these absences is that vultures shifted to satellite roosts that were beyond the limited detection range of our receivers. This is exemplified by vulture V47, which we never detected with a receiver but which we observed on 4 occasions at feeding sites 8 to 25 km from the Radford roost. Also, some birds could have been absent because of the onset of breeding. Both sexes contribute to incubation and brooding, so it is possible that birds were absent while attending to eggs or recently hatched young. Alternatively, some winter-resident birds might have moved out of the area altogether.

A common feature of the 4 livestock operations we monitored, and one additional site where we made several trips to observe vultures, was the availability of livestock carcasses. In most cases, the carcasses were located at a dump site maintained by the operator for that purpose. Other times, carcasses were left in the pasture prior to removal for burial or incineration. Management recommendations for prevention of vulture depredations always include prompt removal and proper disposal of carcasses to reduce the attractiveness of the site for vultures (e.g., USDA 2003). A food source that attracts vultures will likely increase the chances that one or more black vultures will then turn their attention to live animals. Practical considerations might prevent the prompt removal and disposal of carcasses by burial or incineration, but serious attention to such matters could reduce exposure of livestock to black vultures.

In Maryland, Pennsylvania, and North Carolina, livestock and poultry comprise the majority of food items for black vultures (Coleman and Fraser 1987, Rabenold 1987*b*). We do not know the relative importance of livestock to the black vulture population in the New River Valley. There are dozens of cattle and sheep operations in the area, however, and it is conceivable that the availability of cattle, sheep, and other farm animal carcasses contributes substantially to the environmental carrying capacity for black vultures. If carcass dump sites are maintained in the same locations year after year, a traditional feeding pattern could become established in local populations of these long-lived birds. Having reliable sources of food would presumably make it easier for vultures to meet their nutritional requirements and would certainly ease the transition of newly fledged birds from dependence to independence. A similar situation has been documented for common raven (*Corvus corax*) populations in the southern California (Webb *et al.* 2004). As with the raven, predictable food resources that are the result of human activity likely will have a positive effect on vulture survivorship and productivity. It is reasonable then to conclude that a strategy for reducing vulture populations might include denying vultures' access to predictable food sources, particularly livestock carcass dump sites.

FUTURE RESEARCH DIRECTIONS

Because vultures have alternatives to the Radford city roost, it seems unlikely that further attempts to manage livestock by dispersing only the Radford roost site will be successful. Rather, attempts to reduce predation by black vultures on livestock by roost dispersal will require a coordinated effort to identify and disperse the network of communal winter roosts used by vultures within the New River Valley. The practicality of undertaking such an effort needs to be determined.

While black vultures no doubt exploit feeding opportunities provided by livestock operations in the area, the relative importance of livestock in the diet of black vultures is not yet clear. To understand more completely how livestock fits into the feeding patterns of the local black vulture population, additional study of food habits of vultures in the New River Valley area is warranted. Previous investigations of vulture food habits have incorporated both pellet analysis and direct observation (Yahner *et al.* 1986, Coleman and Fraser 1987). Perhaps one means to expand knowledge of black vulture dietary habits is to initiate similar efforts to include regular pellet collections at Radford-area roost sites.

The black vulture population in the New River Valley appears to be healthy, but there is a lack of quantitative information on population size and annual survival. In this study, we tagged and released 200 black vultures. By developing and carrying out a long-term trap, mark, and release program that builds on the marked birds already in the population, it should be possible to acquire data necessary to construct population size estimates and also to assess annual survival. Furthermore, new research findings could provide means to quantify age structure of the population, which is another critical yet unknown aspect of the black vulture population biology (Chaney 2003).

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LITERATURE CITED

AVERY, M. L., J. S. HUMPHREY, E. A. TILLMAN, K. O. PHARES, AND J. E. HATCHER. 2002. Dispersal of vulture roosts on communication towers. J. Raptor. Res. 36:44-49.

CHANEY, R. C., JR., K. P. BLEMINGS, J. BONNER, AND H. KLANDORF. 2003. Pentosidine as a measure of chronological age in wild birds. Auk 120:394-399.

COLEMAN, J. S., AND J. D. FRASER. 1987. Food habits of black and turkey vultures in Pennsylvania and Maryland. J. Wildl. Manage. 51:733-739.

GLAHN, J. F., G. ELLIS, P. FIORNELLI, AND B. S. DORR. 2000. Evaluation of moderate- and low- powered lasers for dispersing double-crested cormorants from their night roosts. Proc. Wildl. Damage Control Conf. 9:34-48.

LOWNEY, M. S. 1999. Damage by black and turkey vultures in Virginia, 1990-1996. Wildl. Soc. Bull. 27:715-719.

PRATHER, I. D., R. N. CONNER, AND C. S. ADKISSON. 1976. Unusually large vulture roost in Virginia. Wilson Bull. 88: 667-668.

RABENOLD, P. P. 1987*a*. Roost attendance and aggression in black vultures. Auk 104:647-653.

RABENOLD, P. P. 1987*b*. Recruitment to food in black vultures: evidence for following from communal roosts. Anim. Behav. 35:1775-1785.

ROADS, K. M. 1936. Black vultures kill and eat new-born lambs. Wilson Bull. 48:219.

STOLEN, E. D. 1996. Roosting behavior and foraging ecology of black vultures in central Florida. M.S. thesis, University of Central Florida, Orlando, FL.

SWEENEY, T. M., AND J. D. FRASER. 1986. Vulture roost dynamics and monitoring techniques in southwest Virginia. Wildl. Soc. Bull. 14:49-54.

SWEENEY, T. M., J. D. FRASER, AND J. S. COLEMAN. 1985. Further evaluation of marking methods for black and turkey vultures. J. Field Ornithol. 56:251-257.

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.

USDA (UNITED STATES DEPARTMENT OF AGRICULTURE). 2003. Fact sheet – managing vulture damage. Wildlife Services, Pittstown, NJ. 4 pp.

WALLACE, M. P., P. G. PARKER, AND S. A. TEMPLE. 1980. An evaluation of patagial markers for cathartid vultures. J. Field Ornithol. 51:309-314.

WEBB, W. C., W. I. BOARMAN, AND J. T. ROTENBERRY. 2004. Common raven juvenile survival in a human-augmented landscape. Condor 106:517-528.

YAHNER, R. H., G. L. STORM, AND A. L. WRIGHT. 1986. Winter diets of vultures in southcentral Pennsylvania. Wilson Bull. 98:157-160.