BAPTISTA, L. F. 1987. Andrew Jackson Grayson and the "Solitary Dove." Pacific Discovery 40(2):29–37.

BRATTSTROM, B. H. AND T. R. HOWELL. 1956. The birds of the Revilla Gigedo [*sic*] islands, Mexico. Condor 58:107–120.

GRAYSON, A. J. 1872. List of Socorro birds collected by A. J. Grayson, May, 1867. Proc. Boston Soc. Nat. Hist. 14:290–302. [N.B.—This paper is usually cited as "Lawrence, 1871," but it was merely *edited* by Lawrence, the wording being entirely Grayson's, and it was actually published in 1872].

GULLEDGE, J. L. 1975. A study of phenetic and phylogenetic relationships among the mockingbirds, thrashers and their allies. Ph.D. diss., City Univ. of New York, New York, New York.

JEHL, J. R., JR. AND K. C. PARKES. 1982. The status of the avifauna of the Revillagigedo Islands, Mexico. Wilson Bull. 94:1–19.

——— AND ———. 1983. "Replacements" of landbird species on Socorro Island, Mexico. Auk 100:551–559.

MCLELLAN, M. E. 1926. Expedition to the Revillagigedo islands, Mexico, in 1925. VI. The birds and mammals. Proc. California Acad. Sci., 4th ser., 15:297–322.

VILLA R., B. 1960. Vertebrados terrestres. La Isla Socorro, Monogr. Inst. Geofísica, Univ. Nal. Auton. Mexico 2:203–216.

WILEY, J. W. AND B. N. WILEY. 1979. The biology of the White-crowned Pigeon. Wildlife Monogr. 64.

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Winter diets of vultures in Pennsylvania and Maryland.—Black Vulture (*Coragyps atratus*) and Turkey Vultures (*Cathartes aura*) have declined in recent decades (Brown 1976). Food habits of these two species have been examined by analysis of regurgitated-pellets or by behavioral observations of marked birds at single roosts (Paterson 1984, Yahner et al. 1986, Coleman and Fraser 1987). No studies have compared winter food habits of vultures among communal roosts. Our objectives were to: (1) compare winter diets of vultures at seven communal roosts in southern Pennsylvania and northern Maryland, and (2) determine if food remains constituting winter diets were related to potential availability of these remains or to habitat features in the vicinity of roosts.

Study area and methods.—We conducted the study at seven winter communal roosts used by Black and Turkey vultures; each roost was located in a different county of southern Pennsylvania and northern Maryland (Thompson 1987). Major land uses in these counties were forest, agriculture, and residential (U.S. Bureau of the Census 1986). One-hundred ninety-two pellets were gathered at the seven roosts (N = 21–30/roost) in early to mid-February 1987. All visible pellets were gathered during a single visit to a roost to minimize differences in the effects of weather (e.g., depth of snow cover) on food items used by vultures (see Yahner et al. 1986). Based on appearance, we estimated that pellets collected were less than two weeks since egestion. Distances between roosts varied from 31 to 163 km and averaged 106 ± 41 km [SD]. Mean numbers of wintering Black and Turkey vultures/roost were 65 ± 65 [SD] and 136 ± 122, respectively (Thompson 1987). We have no evidence that vultures were segregated by species within roosts (Yahner et al. 1986, Thompson 1987).

TABLE 1

PERCENT OCCURRENCE OF ANIMAL FOOD REMAINS AND NUMBER OF ROOSTS IN WHICH A PARTICULAR FOOD REMAIN WAS CONTAINED IN PELLETS

Food remains	Percent occurrence	Number of roosts
Domestic poultry		
Chicken (*Gallus gallus*) and Turkey (*Melagris gallapavo*) combined	64.1	7
Large domestic mammal		
Cow (*Bos taurus*)	32.3	7
Pig (*Sus scrofa*)	8.9	6
Sheep (*Ovis aries*)	6.8	5
Goat (*Capra hircus*)	2.6	2
Subtotal	50.5	7
White-tailed deer (*Odocoileus virginianus*)	40.1	7
Small mammal		
Virginia opossum (*Didelphis virginiana*)	6.8	5
Eastern cottontail (*Sylvilagus floridanus*)	11.5	4
Gray squirrel (*Sciurus carolinensis*)	2.1	3
White-footed mouse (*Peromyscus leucopus*)	0.5	1
Meadow vole (*Microtus pennsylvanicus*)	3.6	2
S. red-backed vole (*Clethrionomys gapperi*)	0.5	1
Striped skunk (*Mephitis mephitis*)	4.7	4
Raccoon (*Procyon lotor*)	2.6	2
Domestic cat (*Felis catus*)	7.3	5
Subtotal	39.6	6
Miscellaneous bird		
Unidentified vulture	7.3	5
Unidentified passerine	1.0	2
Subtotal	8.3	5
Plant material	81.8	7

Pellets egested by Black Vultures could not be distinguished from those egested by Turkey Vultures, so data were pooled from both species (Yahner et al. 1986, Coleman and Fraser 1987).

We oven-dried pellets for 24 h and separated them under a dissecting microscope. Cuticular scale patterns of hairs and intact hairs were examined with a stereoscope or a compound microscope and compared to reference slides and a hair guide (Adorjan and Kolenosky 1969) to identify animal species (Yahner et al. 1986). All white feathers were presumed to be domestic chicken (scientific names in Table 1) or domestic turkey, because both species were abundant in counties containing the roosts (U.S. Department of Commerce 1984a, b). Presence or absence, rather than volume, was noted for each animal food remains because of differences in digestibility of animal food (Coleman and Fraser 1987). Occurrence of plant material, but not the species, also was noted for each pellet.

We determined the frequency of occurrence of each animal food remain based on the total number of pellets in which a given animal species occurred in pellets from each roost. Animal food remains were placed in five general categories: domestic poultry, large domestic mammal, white-tailed deer, small mammal, and wild bird. Frequencies of occurrence of remains in each category, based on presence or absence of remains in the total number of pellets/roost, were compared among roosts using 2×7 G-tests-of-independence (Sokal and Rohlf 1981:744); if frequency of a category was significant ($P < 0.05$) among roosts, a 2×2 G-test-of-independence was used about the roost of interest to determine whether or not frequency of occurrence differed significantly ($P < 0.05$) from expected (Sokal and Rohlf 1981:744).

Percent similarity in winter pellets was determined for each pair of roosts using the proportional similarity index (Brower and Zar 1984:161). Food remains used to calculate the index were individual species of animals that occurred in at least 15 of the 192 pellets and included poultry, domestic cow, domestic pig, deer, and eastern cottontail. Relationships between percent similarity and distance (km) separating each pair of roosts were determined by product-moment correlation analyses of untransformed and log-transformed data (Sokal and Rohlf 1981:565).

County-wide production of livestock and poultry (U.S. Department of Commerce 1984a, b) and county-wide numbers of harvested and road-killed deer combined (Pennsylvania Game Commission and Maryland Department of Natural Resources, unpubl.) were used to represent the potential availability of animal food to vultures (Thompson 1987). These data were compared to frequencies of occurrence of poultry, large domestic mammals, and deer in pellets from a roost in a corresponding county via product-moment correlation analyses. We also examined associations between frequencies of occurrence of the five categories of animal food remains with 10 habitat features of roosts, using correlation analyses. These features, described by Thompson (1987), were percent slope at roost center; cover-type diversity (CD) within a 1.6-km radius of a roost, where $CD = \Sigma p_i \log_e p_i$, with p_i = proportion of the ith cover type within a 1.6-km radius of a roost; interspersion of cover types (Heinen and Cross 1983), both within a 1.6-km radius of a roost and immediately adjacent to a roost; distances (m) of a roost to the nearest road, occupied human habitation, food resource (e.g., cattle feedlot, poultry farm), and lake; and land-surface ruggedness (Beasom et al. 1983) within a 40-ha circle superimposed over the center of a roost and within a 1.6-km radius of a roost.

Results and discussion.—Animal food remains from 16 species were found in our sample of 192 pellets (Table 1). Poultry and large domestic mammal remains occurred most frequently in vulture pellets from the seven roosts. Deer and small mammal remains occurred less often in pellets. Eastern cottontails, domestic cats, and Virginia opossums were the predominant small mammal remains in pellets. Vulture feathers in pellets were probably ingested while preening. Plant material was found in 82% (N = 157) of the pellets.

Our study, and others in the Mid-Atlantic states (e.g., Paterson 1984, Yahner et al. 1986, Coleman and Fraser 1987), have shown that wintering vultures occupying communal roosts depend on a variety of domestic and wild carrion. In these studies, remains of poultry, large domestic mammals, and deer occurred in a high proportion of vulture pellets. Use of carrion of domestic cattle by vultures might be greater than that actually obtained from regurgitated-pellet analysis, because offal and afterbirth from cattle do not show up in pellets (Coleman and Fraser 1987). As in our study, plant material can occur in a large proportion of pellets (Paterson 1984, Prior 1986). We are uncertain whether plant material was ingested purposely or perhaps accidently by vultures feeding on carrion (Paterson 1984).

Occurrence of poultry, large domestic mammals, and small mammals in vulture pellets differed among roosts (Table 2). In general, occurrence of domestic animal food remains

TABLE 2

PERCENT OCCURRENCE OF FOUR CATEGORIES OF ANIMAL FOOD REMAINS IN VULTURE PELLETS COLLECTED DURING FEBRUARY 1987

Category	Roost, county, and state						
	Big Round Top Adams, PA (N = 30)	Meadow Grove Perry, PA (N = 21)	Mount Gretna Lebanon, PA (N = 30)	Muddy Run York, PA (N = 30)	Octararo Lake Chester, PA (N = 21)	Deep Run West Carroll, MD (N = 30)	Lake Linganore Frederick, MD (N = 30)
Domestic:	83.3	95.2	100.0	83.3	95.2	80.0	73.3
Poultry[a]	60.0	52.3	100.0[b]	56.7	85.7[b]	43.3[c]	53.3
Large domestic mammal[a]	36.7	100.0[b]	40.0	33.3[c]	57.1	50.0	50.0
Wild:	80.0	23.8	50.0	23.3	57.1	66.7	70.0
White-tailed deer	56.7	28.6	33.3	26.7	33.3	40.0	56.7
Small mammal[a]	63.3[b]	0.0[c]	36.7	10.0[c]	47.6	73.3[b]	46.7

[a] Species comprising each category are given in Table 1. Observed frequency of occurrence was significantly different from expected; $P < 0.01$, 2×7 G-test-of-independence.

[b] Frequencies of a food item were significantly ($P < 0.05$) greater than expected.

[c] Frequencies were less than expected based on 2×2 G-tests-of-independence about the roost of interest.

(poultry and large domestic mammal) in pellets/roost varied from 73.3% (Lake Linganore Roost) to 100.0% (Mount Gretna Roost); occurrence of wild remains (deer, small mammal, wild bird) varied from 23.3% (Muddy Run Roost) to 80.0% (Big Round Top Roost). Vultures used poultry extensively at Mount Gretna and Octararo Lake, large domestic mammals at Meadow Grove, and small mammals at Big Round Top and Deep Run West. Use of deer did not differ from expected ($0.05 < P < 0.10$) at any roost but was highest (>56%) at Big Round Top and Lake Linganore.

Paterson (1984) noted a 70% use of poultry by vultures in a Virginia roost. At the Big Round Top Roost, poultry occurred in 60.0% of the pellets in 1987 (present study) but in only 49.0% of the pellets in winters 1982–83 and 1983–84 (Yahner et al. 1986). Similarly, frequencies of occurrence of large domestic mammals in vulture pellets differed among roosts, ranging from 16.4% (Coleman and Fraser 1987) to 100% (Meadow Grove Roost, present study).

Although Turkey Vultures use smaller carrion (e.g., small mammals) more often than Black Vultures (based on observations of marked birds; Coleman and Fraser 1987), use of small mammals by vultures can vary widely among roosts (e.g., 0%, Meadow Grove; 73.3%, Deep Run West). However, there is no direct evidence that use of smaller carrion by the less aggressive Turkey Vulture is a result of use of larger carrion (e.g., deer) by the more aggressive Black Vulture (Coleman and Fraser 1987).

Percent similarity in use of animal food remains between roosts ranged from 58 to 91% ($\bar{x} = 75 \pm 8\%$). Greatest similarity was found between Muddy Run and Mount Gretna Roosts (91%), which were 84 km apart, and between Big Round Top and Deep Run West roosts (90%), which were 35 km apart. Least similarity occurred between Meadow Grove and Big Round Top roosts (58%) which were 100 km apart. Percent similarity and distance (km) between roosts were not correlated ($r = -0.34$, $df = 19$, $P > 0.05$).

Frequencies of occurrence of poultry, large domestic mammals, cows, or deer were not associated with county-wide production of domestic animals or with county-wide deer

harvests or roadkills combined (r's = −0.73 to 0.24, df = 5, $P > 0.05$). Three reasons might account for our inability to find a relationship between occurrence of remains and county-wide indices of potential food. First, vultures are opportunistic foragers and rely on localized, emphemeral food resources (Sweeney and Fraser 1986). Second, the availability of carrion of domestic animals varies among landowners, depending on how they comply with local animal disposal laws (Coleman and Fraser 1987). Third, our pellet samples were taken during one month in winter. If we had the opportunity to examine more pellets/roost or pellets among seasons, perhaps relationships between diet and potential food availability would become more evident.

Frequencies of occurrence of deer in pellets/roost and numbers of deer harvested and road-killed in a given county also were not associated, because use of deer by wintering vultures might be a localized rather than a county-wide phenomenon. For instance, in our study and in others (Yahner et al. 1986, Coleman and Fraser 1987), deer were an important food source for vultures in the immediate vicinity of the Big Round Top Roost. Numbers of road-killed deer near Big Round Top Roost are much higher than elsewhere in Adams County (H. Greenlee and L. Haines pers. comm.).

Availability of small mammals during winter may decline because increased snow cover presumably reduces the ability of vultures to find road-killed small mammals (Yahner et al. 1986). Yahner et al. (1986) found that small mammals occurred in 20.9% and 9.3% of vulture pellets during snow-free (snow depth <7.6 cm) and snow-covered periods (>7.6 cm), respectively. In the present study, snow cover seldom exceeded 7.6 cm in February, thereby possibly accounting for high use of small mammals in most roosts in winter 1987.

Frequencies of occurrence of poultry in vulture pellets were correlated with land-surface ruggedness within 40 ha of a roost ($r = -0.79$, df = 5, $P < 0.05$), both large domestic mammals and cows with slope ($r = 0.86$, df = 5, $P < 0.05$) and land-surface ruggedness within a 1-km radius of a roost ($r > 0.79$, df = 5, $P < 0.05$), and deer with interspersion of cover types immediately adjacent to a roost ($r = -0.87$, df = 5, $P < 0.05$). Frequencies of occurrence of small mammals in pellets were not related ($P > 0.05$) to habitat features of roosts.

Relationships between diet and habitat features in the vicinity of roosts were difficult to interpret. For example, in Pennsylvania, a mix of farm and forest habitats are associated with high deer densities (Storm and Yahner, unpubl. data), and hence frequencies of deer in pellets might be expected to increase with interspersion of farm and forest types immediately adjacent to a roost. However, we found an indirect relationship between deer in pellets and cover types in our study. Although habitat features associated with roosts measured in our study may not be helpful in predicting winter diets of vultures using a given roost, they have been found to be important in roost-site selection by vultures. Wright et al. (1986) and Thompson (1987), for instance, found that mature coniferous stands were selected as communal roosts by wintering vultures in southern Pennsylvania and northern Maryland.

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LITERATURE CITED

ADORJAN, A. S. AND G. B. KOLENOSKY. 1969. A manual for the identification of hairs of selected Ontario mammals. Res. Rep. (Wildlife). No. 90. Res. Branch Ontario Dept. Lands and Forest, Toronto, Ontario.

BEASOM, S. L., E. P. WIGGERS, AND J. R. GIARDINO. 1983. A technique for assessing land surface ruggedness. J. Wildl. Manage. 47:1163–1166.

BROWER, J. E. AND J. H. ZAR. 1984. Field and laboratory methods for general ecology. Wm. C. Brown, Dubuque, Iowa.

BROWN, W. H. 1976. Winter population trends in Black and Turkey vultures. Am. Birds 30:909–912.

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.

HEINEN, J. AND G. H. CROSS. 1983. An approach to measure interspersion, juxtaposition, and spatial diversity from different cover-type maps. Wildl. Soc. Bull. 11:232–237.

PATERSON, R. L., JR. 1984. High incidence of plant material and small mammals in the autumn diet of Turkey Vultures in Virginia. Wilson Bull. 96:467–469.

PRIOR, K. A. 1986. The feeding ecology and behavior of Turkey Vultures (*Cathartes aura*) in southern Ontario. 4th-year thesis. Trent Univ., Peterborough, Ontario.

SOKAL, R. R. AND F. J. ROHLF. 1981. Biometry. Freeman, San Francisco, California.

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

THOMPSON, W. L. 1987. Distribution and characteristics of vulture winter communal roosts in southern Pennsylvania, northern Maryland, and northeastern Virginia. M.S. thesis, Pennsylvania State Univ., University Park.

U.S. BUREAU OF THE CENSUS. 1986. Statistical abstract of the United States: 1987. 107th ed. U.S. Gov. Printing Off., Washington, D.C.

U.S. DEPARTMENT OF COMMERCE. 1984a. 1982 census of agriculture—Maryland. Vol. 1, Part 20.

———. 1984b. 1982 census of agriculture—Pennsylvania. Vol. 1, Part 38.

WRIGHT, A. L., R. H. YAHNER, AND G. L. STORM. 1986. Roost-tree characteristics and abundance of wintering vultures at a communal roost in south central Pennsylvania. Raptor Res. 20:102–107.

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

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Singing behavior of American Robins in linear and non-linear habitats.—This study documents a difference in singing behavior between two populations of American Robins (*Turdus migratorius*) inhabitating neighboring but dissimilar areas. To our knowledge, significant interpopulation differences in response to playback have not been reported previously.

In the northern plains of the United States, trees and shrubs growing along creeks and rivers or in shelterbelts provide the only natural nesting sites for tree-nesting birds such as