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Turkey Vulture food habits in southern Ontario.—Where Turkey Vultures (*Cathartes aura*) live sympatrically with other New World vultures (Cathartidae), they forage individually or in widely scattered small groups and usually feed on small carcasses (Rabenold 1983, Paterson 1984, Houston 1986, Coleman and Fraser 1987). However, where Turkey Vultures

breed in the absence of other vultures, no data are available on their foraging ecology. My principal objective, therefore, is to provide new information on Turkey Vulture foraging ecology in this part of their range. My secondary objective arises from the opportunity provided by studying Turkey Vultures in allopatry with respect to other vultures. Diet assessment of vultures often relies on analyzing regurgitated pellets collected at roosts. Since Turkey Vultures often roost with Black Vultures (*Coragyps atratus*), previous studies have been unable to distinguish between pellets produced by the two species (Yahner et al. 1986, Coleman and Fraser 1987). Because all pellets in my study area are from Turkey Vultures, I can determine whether the shapes and sizes of Turkey Vulture pellets are species-specific and evaluate Turkey Vulture diets more precisely.

Study area and methods.—Fieldwork was conducted near Milton in the Halton Region of southern Ontario. Approximately two-thirds of the land remains as farmland and wooded areas; the rest is urban. Two roosting sites were located in forests owned and operated by the Halton Region Conservation Authority. The first was situated at the bottom of Nassagaweya Canyon within Rattlesnake Conservation Area. At this site, vultures roosted in seven large sugar maples (*Acer saccharum*) and one large beech (*Fagus grandifolia*). The second roost was located approximately 5 km north of the first roost, at the edge of a 35-ha water reservoir within Hilton Falls Conservation Area. At this site, vultures used several large trembling aspens (*Populus tremuloides*) growing at the base of a 9-m cliff. Observations of foraging groups were made opportunistically from a car from 10 June through 7 October 1984 and from 9 April through 12 October 1985, between 11:00 and 16:00 h EST. Following Rabenold (1983), birds were considered to be in the same foraging group whenever they were observed in the air within 1 km of one another. Foraging observations were made at a distance of at least 1.6 km from the nearest known roost in order to avoid confusion with roost arrivals and departures.

Vulture pellets (N = 200) were collected from the two roosting sites between 11 June and 4 October 1985. A sample of 63 pellets (33 from Nassagaweya Canyon and 30 from Hilton Falls) were selected at random to determine dietary composition and relative frequency of food types used by vultures in this region. Pellets were air-dried, measured using calipers to nearest mm, weighed with an electronic balance to the nearest mg, and soaked overnight in water for dissection. A random sample of 100 hairs was removed from each pellet and cuticular impressions were made (Williamson 1951). A regional reference collection and hair guide (Adorjan and Kolenosky 1969) were used to identify mammal hairs microscopically. All mammal species were identified by hairs alone, while non-mammal species were identified by diagnostic parts (e.g., feathers) found in pellets.

Results.—Turkey Vultures in Ontario foraged solitarily in 56% of my observations (Table 1). This pattern differed significantly from the results of observations made in North Carolina (Stewart 1978, Rabenold 1983), where Turkey Vultures forage in larger groups (Kolmogorov-Smirnov, two-sample test; both P's < 0.001).

Because carrion varies in digestability, data from pellet analyses may not indicate the importance of particular food items. Nonetheless, they do allow comparisons of carrion used by Turkey Vultures among regions. Turkey Vultures in Ontario consume a variety of carrion types (Table 2). Only domestic fowl and woodchuck occurred in more than 50% (N = 31) of the pellets. Ninety-four percent of the pellets I analyzed contained two or more species, compared to 26% found by Paterson (1984) ($\chi^2 = 55.33$, $P < 0.001$). Overall, this represents a greater variety than reported for other areas.

To test for differences in the size of carcasses fed on by Turkey Vultures in Ontario and those living in other regions, all identified prey species were grouped, according to average live weight, into the size classes used by Coleman and Fraser (1987). Small species (<10 kg) were found to have a frequency of occurrence of 82%, medium species (10–20 kg), a

TABLE 1

COMPARISON OF TURKEY VULTURE FORAGING GROUP SIZE BETWEEN SOUTHERN ONTARIO AND NORTH CAROLINA

Group size	Number of times observed					
	Southern Ontario (this study)		North Carolina (Stewart 1978)		North Carolina (Rabenold 1983)	
	N	%	N	%	N	%
1	79	56.4	18	27.6	100	29.5
2	35	25.0	21	32.3	116	34.2
3	8	5.7	16	25.0	46	14.1
4	9	6.4	8	12.3	30	9.0
5	—	—	2	3.1	17	5.0
6	3	2.1	—	—	9	3.1
7	2	1.4	—	—	6	2.1
8	—	—	—	—	5	1.5
9	—	—	—	—	1	0.3
10	—	—	—	—	3	1.0
11	1	0.7	—	—	1	0.3
12	2	1.4	—	—	—	—
13	—	—	—	—	4	1.2
20	1	0.7	—	—	—	—
21	—	—	—	—	1	0.3
Mean group size =	2.11		2.31		2.75	

frequency of 13%, and large species (>20 kg), a frequency of 5%. Comparisons with studies in Virginia (Paterson 1984) and Pennsylvania and Maryland (Coleman and Fraser 1987) revealed that Turkey Vultures in Ontario fed significantly more on small carrion ($\chi^2 = 22.58$ and 32.84, respectively; both P's < 0.001). Sixty-two percent of the animal groups detected were of wild origin. Both Paterson (1984) and Coleman and Fraser (1987) found a significantly greater reliance upon domestic carrion in sympatric populations ($\chi^2 = 3.88$, $P < 0.005$; and $\chi^2 = 5.60$, $P < 0.025$, respectively).

Discussion.—Turkey Vultures in Ontario forage in smaller groups, feed on the carrion of smaller species, and feed proportionately more on wild species than has been found elsewhere. In addition, the number of species identified per Turkey Vulture pellet in Ontario exceeds that found in pellets collected in the mid-eastern United States.

Lower population densities of Turkey Vultures in Ontario, relative to more southern parts of their range, may be responsible for the small size of foraging groups I observed, whereas differences in diet between regions may be attributable to several factors. First, because the pellets of Turkey and Black vultures are not distinguishable, Paterson's (1984) sample may have included pellets from Black Vultures. Both species use the roost from which Paterson (1984) collected pellets (Fraser, pers. comm.). Thus, the analysis of Turkey Vulture diets may have been confounded in this study. Second, Coleman and Fraser (1987) collected their data by radio-tracking vultures to feeding sites which, as they note, may preclude the observation and identification of very small carrion that is consumed. Radio-tracking may also be biased towards the detection of completely digestible food items such as livestock afterbirth and offal, food sources which would not be detectable by pellet analysis. A third

TABLE 2
PERCENT OF TURKEY VULTURE PELLETS FROM SOUTHERN ONTARIO IN WHICH FOOD TYPE WAS FOUND (N = 63)

	%
Non-mammal	
Feathers (primarily *Gallus gallus*)	68
Invertebrates (primarily Coleoptera)	24
Vegetation	100
Mammal—domestic	
Dog (*Canis familiaris*)	2
Horse (*Equus caballus*)	2
Pig (*Sus scrofa*)	10
Cow (*Bos taurus*)	8
Bison (*Bison bison*)	3
Sheep (*Ovis aries*)	3
Mammal—wild	
Opossum (*Didelphis marsupialis*)	2
Shrew (Soricidae)[a]	27
Mole (Talpidae)[a]	8
Raccoon (*Procyon lotor*)	18
Striped Skunk (*Mephitis mephitis*)	18
Red Fox (*Vulpes fulva*)	2
Woodchuck (*Marmota monax*)	53
Red Squirrel (*Tamiasciurus hudsonicus*)	3
Grey Squirrel (*Sciurus carolinensis*)	2
Beaver (*Castor canadensis*)	2
Meadow Vole (*Microtus pennsylvanicus*)	2
Muskrat (*Ondatra zibethica*)	13
Eastern Cottontail (*Sylvilagus floridanus*)	9

[a] Possibly more than one species in the family present.

alternative for the differences in diets found in different studies is that the diets may reflect the carrion size-classes most readily available in each location. A detailed inventory of carrion availability in each study area would be necessary to assess the merit of this explanation.

Perhaps more interesting than the differences between Turkey Vulture diets in Ontario and elsewhere are the similarities. Overall, Ontario Turkey Vultures retained the small foraging group size and reliance on small carrion typical of this species where it is sympatric with Black Vultures. Both Stewart (1978) and Coleman (1985) have suggested that competition between the two species forced Turkey Vultures to exploit the small group-small carcass niche.

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Marking passerine tail feathers with colored tape.—Numerous techniques have been used to mark small birds, thus enabling them to be recognized at a distance when resighted (for a review see Marion and Shamis 1977). These methods have included colored leg bands, colored streamers, patagial tags, and coloring or marking plumage. Among the latter group are various schemes to mark the tail feathers (rectrices) of birds.

Colored leg bands have been used widely to mark birds, particularly for studies in open habitats with relatively short and/or sparse vegetation. Leg bands work best for species that can be approached closely and that do not conceal their legs when perched (Samuel 1970, pers. obs.). In "closed" habitats with dense tree and shrub cover, and for species often only sighted in flight or whose legs are not easily seen when the bird is perched, other, more visible markers (streamers, patagial tags, marking plumage, etc.) have been developed. Generally, more handling time and greater skill are required when these markers are applied to birds than when colored leg bands are used. Also, there may be a greater risk of a bird being injured either during the marking process or after its release (e.g., Hewitt and Austin-Smith 1966, pers. obs.).