

COMPARISON OF DIETS OF TURKEY VULTURES IN THREE REGIONS OF NORTHERN MEXICO

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Abstract.—In three regions of northern Mexico the food habits of Turkey Vultures (*Cathartes aura*) were determined by pellet analyses. Turkey Vultures selected small prey items in a cultivated area but used large carcasses (ungulates) in desert border and mountain areas. These dietary differences may have resulted from Black Vultures (*Coragyps atratus*) being able to exclude Turkey Vultures from large carcasses in areas where Black Vultures are common.

COMPARACIÓN DE LA DIETA DE *CATHARTES AURA* EN TRES REGIONES DEL NORTE DE MEXICO

Sinopsis.—Se estudió la alimentación del aura (*Cathartes aura*) en tres regiones del norte de México mediante el análisis de egagrópilas. En un área cultivada las auras se alimentaron de cadáveres de pequeños animales, no obstante aprovechaban grandes carroñas (ungulados) en el borde del desierto y en áreas montañosas. Estos cambios en la dieta pueden deberse a que los zopilotes (*Coragyps atratus*) excluyen a las auras de las carroñas de grandes animales en áreas donde las auras son inferiores en número.

Information on the food habits of the Turkey Vulture (*Cathartes aura*) in North America has been mainly qualitative and anecdotal (see Jackson 1988, Paterson 1984, for reviews). Moreover, analysis of pellets collected at roosts have often been compromised by the fact that roosts commonly included other species in addition to the Turkey Vulture and pellets have been difficult to assign to species (Coleman and Fraser 1987, Yahner et al. 1986). In addition, studies of geographic variation in the diet of the Turkey Vulture are lacking. In this paper, we describe the variation in the food habits of the Turkey Vulture in three regions of northern Mexico and examine some factors that potentially influence the differences in diet.

STUDY AREA AND METHODS

Investigations were carried out in three regions of northern Mexico: Los Mochis (Sinaloa), Gómez Palacios (Durango) and the Biosphere Reserve of La Michilía (Durango). The site near Los Mochis was an area of thorn woodland 150 m above sea level; average monthly temperatures were 13–27 C and average annual rainfall was 400 mm. Most of the natural vegetation of this area has been removed and irrigated farmland predominates. The site near Gómez Palacios was a desert border 2100 m above sea level; average monthly temperatures were 13–27 C and the average annual rainfall was 200 mm. The Biosphere Reserve of La Michilía was an oak-pine forest with oak-juniper grassland at 2400 m; average monthly temperatures were 12–28 C and average annual rainfall was 600 mm (Folliot and Gallina 1981, Rzedowski 1981).

Food habits of Turkey Vultures were studied by analysis of pellets collected in roosts from 17 Oct. to 10 Nov. 1982. The pellets were collected on a single day in each place and all were fresh (not dismembered). So, it can be inferred that they were deposited on the days prior to collection. All the Turkey Vulture roosts were monospecific, such as was known by observations made on the days of the present study and in former seasons (pers. obs.). We analyzed 110 pellets from Los Mochis, 60 from Gómez Palacios and 60 from La Michilía. Hair, bone, feathers and scales were used to identify prey remains by comparison to a reference collection. We considered two different methods to count prey. For each prey species, we calculated the percentage of the total number of pellets and of the total number of prey (considering each pellet as a different sample because bones rarely appeared in pellets and, therefore, the calculation of minimum numbers was impossible). Prey were assigned to five weight categories arranged in an exponential series (Hespenheide 1971, Schoener 1969): <0.1, 0.1–0.5, 0.6–2.5, 2.6–12.5 and >12.5 kg, assuming that prey consumed were adult individuals. Road-count transects (Fuller and Mosher 1987, Hubbard 1983) were carried out on the same dates as pellets were collected. These transects (one in each locality) totalled 19 km in Los Mochis, 100 km in Gómez Palacios and 91 km in La Michilía. Three observers identified and counted flying birds on a 300-m wide strip along both sides of the road. Censuses were conducted only under conditions of good visibility, within homogeneous habitats, during the middle hours of the day, far from vulture roosts, and while driving at 30–40 km/h.

RESULTS

Mammals predominated in the diet of Turkey Vultures in all three localities (Table 1). Small mammals, mainly cotton rats (*Sigmodon* spp.) predominated in Los Mochis, domestic ungulate, mainly pigs, in La Michilía, and no group predominated in Gómez Palacios. Many juniper berries (*Juniperus* spp.) were present in one pellet collected at La Michilía, whereas grapes were detected in Los Mochis. Food size distributions in the three localities (Table 2) showed striking differences. Small items represented more than 80% of the diet in Los Mochis, whereas prey larger than 12.5 kg were absent from the diet. In Gómez Palacios, most of the items weighed less than 2.5 kg, but 27% of them were large domestic ungulates. A completely different distribution appeared in La Michilía where almost half of the items were large ungulates and the other half small prey under 0.1 kg; intermediate size prey were lacking.

Relative abundance of Turkey Vultures with respect to Black Vultures (*Coragyps atratus*) (T/B) was obtained from the road-count transects. In Los Mochis both species reached similar abundance (T/B = 0.9), in Gómez Palacios the Turkey Vulture predominated (T/B = 2.3) and at La Michilía Black Vultures were almost completely absent (T/B = 21.7). According to Thiollay (1978), the Black Vulture does not breed at La Michilía. Further, it does not often visit feeding places in this locality (Hernández-García 1983). In the three study areas no groups of Turkey

TABLE 1. Percentage of the total number of pellets (% P) and of the total number of prey (% N) in fresh autumn pellets of Turkey Vultures at three localities of northern Mexico.

	Los Mochis		Gómez Palacios		La Michilía	
	% P	% N	% P	% N	% P	% N
Mammals	98.2	76.6	98.3	76.1	81.7	81.7
<i>Felis catus</i>	5.5	4.3	1.7	1.1	—	—
<i>Citellus</i> sp.	—	—	1.7	1.1	—	—
<i>Neotoma</i> sp.	—	—	20.0	13.6	—	—
<i>Sigmodon</i> sp.	89.1	69.5	—	—	33.3	33.3
Unidentified rodents	—	—	10.0	6.8	—	—
<i>Lepus</i> sp.	—	—	23.3	19.6	—	—
Domestic ungulates	—	—	40.0	27.3	48.3	48.3
Unidentified mammals	3.6	2.8	8.3	5.7	—	—
Birds	9.1	7.1	10.0	6.8	3.3	3.3
Anatidae	2.7	2.1	1.7	1.1	—	—
<i>Gallus domestica</i>	—	—	3.3	2.3	—	—
Columbiformes	0.9	0.7	—	—	—	—
<i>Geococcyx californianus</i>	—	—	1.7	1.1	—	—
<i>Sialia mexicana</i>	—	—	—	—	3.3	3.3
Unidentified birds	—	—	3.3	2.3	—	—
Eggs	2.7	2.1	—	—	—	—
Reptiles	22.2	15.5	25.0	17.0	5.0	5.0
<i>Phrynosoma</i> sp.	—	—	3.3	2.3	—	—
<i>Sceloporus</i> sp.	—	—	3.3	2.3	—	—
Unidentified lizards	10.9	6.4	11.7	8.0	—	—
Unidentified snakes	8.2	6.4	5.0	3.4	5.0	5.0
Unidentified reptiles	3.6	2.9	1.7	1.1	—	—
Invertebrates	0.9	0.7	—	—	6.7	6.7
Unidentified Coleoptera	0.9	0.7	—	—	6.7	6.7
Plant matter	—	—	1.7	1.1	3.3	3.3
<i>Juniperus</i> sp. (berries)	—	—	—	—	3.3	3.3
Grapes	—	—	1.7	1.1	—	—
N of pellets or prey	110	141	60	88	60	60

Vultures contained more than 10 birds ($n = 166$ groups). By contrast, 76.2% of Black Vulture groups had more than 10 individuals.

DISCUSSION

Two potential biases may have affected our results. Firstly, the pellets probably were ejected over a few days. Secondly, the car transects were carried out in a single day in each study area. As a consequence, short time changes, in the availability of carrion and the relative abundance of both species of vultures may have influenced our findings. We think, however, that these potential biases do not invalidate our results. Quantitative data are not available for livestock abundance in these areas, but our field observations, indicate that pigs and other livestock were much more common in the highly populated cultivated fields of Los Mochis than in the almost uninhabited desert border of Gómez Palacios and pine-

TABLE 2. Prey size (weight) distribution (% of the total number of prey) in the food of Turkey Vultures at three localities of northern Mexico.

Prey size (kg)	Los Mochis	Gómez Palacios	La Michilía
<0.1	81.56	20.45	46.67
0.1-0.5	7.09	21.59	5.00
0.6-2.5	4.26	30.68	0.00
2.6-12.5	7.09	0.00	0.00
>12.5	0.00	27.27	48.33

oak forest of La Michilía. In fact, Ezcurra and Gallina (1981) claimed that in La Michilía domestic and wild ungulates were very scarce, although they did not provide numerical estimates. So, we can infer that the short-term changes in the availability of carrion of large animals are probably much higher between the study areas than within them. With respect to the relative abundance of vultures, other authors (Blake 1953, Brown and Amadon 1968, Jackson 1988) remark that the Black Vulture is more abundant in lowland areas, reaching high densities in the most human-inhabited regions. In contrast, the Turkey Vulture reaches high altitudes in North America, being common in wilderness areas. In fact, in La Michilía, Thiollay (1978) found the Turkey Vulture as breeder whereas the Black Vulture was absent. As a consequence, it seems that our results reflect a real tendency in the relative abundance of the two species.

Among the possible causes of the difference in the composition of the diet of the Turkey Vultures in the three studied regions were variations in prey availability and variations in interspecific competition with the Black Vulture. Carcasses of large animals (e.g., ungulates) could have been eaten more frequently at La Michilía than at Gómez Palacios and Los Mochis because they were more abundant. The availability of large carcasses seems to be just the opposite, however (see above). Furthermore, we found a very high density of vultures in the Los Mochis area, as was revealed by the road-count transects. Average number of Turkey and Black Vultures observed per km was high at Los Mochis ($7.9 \times 19 = 150$) and low in Gómez Palacios ($0.4 \times 100 = 40$) and La Michilía ($0.75 \times 91 = 68$). This strongly suggested high carrion availability in Los Mochis, because the two species of vultures (especially the Black Vulture) concentrate in places with abundant supplies of cadavers of large animals (Brown and Amadon 1968, Franco 1983).

Possibly, competitive release was occurring. The sociality of Black Vultures during searching activities may permit them to exploit large carcasses more efficiently than Turkey Vultures (Brown and Amadon 1968, Coleman and Fraser 1987, Houston 1988, Stewart 1978). The Turkey Vulture can do well against Black Vultures in one-on-one situations, but is easily overwhelmed by groups of Black Vultures (Houston 1988, Wallace and Temple 1987). Therefore, under high Black Vulture

densities, the Turkey Vulture may be excluded from large carcasses (see also Franco 1983) and restricted to small ones, which it can find thanks to its slow flight close to the ground (Houston 1988, Wallace and Temple 1987), and its well-developed sense of smell (Bang 1964, Houston 1986, Stager 1964). So, the Turkey Vulture could consume quickly the small carcasses before being displaced by Black Vultures. These kinds of dietary shifts, although rarer than habitat shifts (MacArthur and Wilson 1967), are well documented (Schoener 1983, 1986). They usually occur in species of relatively large size (Connell 1975, 1983; Schoener 1974) and high trophic level (Hairston et al. 1960, Schoener 1983, but also see Erlich and Birch 1967), such as the Turkey Vulture.

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