

BURROWING OWL FOODS IN CONATA BASIN, SOUTH DAKOTA

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ABSTRACT.—Burrowing Owls (*Athene cunicularia*) were studied in a prairie dog town of southwestern South Dakota. Pellets regurgitated by Burrowing Owls contained a wide variety of prey remains. Insects, spiders, small mammals, and vegetation were the most frequent items identified in the pellets. Mammals were consumed most frequently during spring and early summer. Insects were consumed in large numbers during the entire period of this study, but they became more frequent in owl pellets during late summer and fall in association with a decline of mammal remains. Some prey items observed around owl nest sites were not found in the pellets examined. Possible secondary poisoning of some prey of Burrowing Owls has not produced any change in owl food habits, based on other studies reported in the literature.

Published information on Burrowing Owls (*Athene cunicularia*) pertains mostly to food habits (Robertson 1929, Hamilton 1940, Sperry 1941, Bond 1942, Marti 1974, Gleason and Craig 1979). However, Thomsen (1971), Coulombe (1971), and Martin (1973) also examined Burrowing Owl behavior and ecology. Little is known about ecology of Burrowing Owls in South Dakota except that they are summer residents in all but the Black Hills area (Whitney et al. 1978).

Burrowing Owls are frequently associated with prairie dogs (*Cynomys ludovicianus*) in southwestern South Dakota, where they use prairie dog burrows as nest sites and escape cover. Aufforth (1981) stated that Burrowing Owl numbers are declining in the Northern Great Plains. The information available on Burrowing Owl population trends in South Dakota suggests, however, that they are stable (N. R. Whitney, pers. comm.). Recent prairie dog poisoning programs may have resulted in the direct or secondary poisoning of Burrowing Owl prey when Compound 1080 and strychnine were in use. Poisoning of Burrowing Owl prey could have altered the food resources of the study area and owl food habits.

The purpose of this study was to examine Burrowing Owl food habits throughout the owl's annual period of residency on the study area.

STUDY AREA AND METHODS

The study was conducted in Conata Basin, which is on the Buffalo Gap National Grasslands in southwestern South Dakota. Conata Basin is a lowland area surrounded by buttes and mesas and is bordered on its northern, eastern, and western edges by Badlands National Park. The basin supports short-grass prairie dominated by blue grama (*Bouteloua gracilis*), buffalo grass (*Buchloe dactyloides*), western wheatgrass (*Agropyron smithii*), ca-rices (*Carex* spp.), red three-awn (*Aristida longiseta*), scarlet globemallow (*Sphaeralcea coccinea*), wooly Indian wheat (*Plantago spinulosa*), and plains prickly pear (*Opuntia polyacantha*).

The study area has been grazed by cattle since 1900, and forage utilization is often in excess of 60% (Uresk et al. 1982). Prairie dogs historically and currently occupy the entire Conata Basin area ($\approx 700 \text{ km}^2$) despite poisoning programs (Merriam 1902). The last major prairie dog poisoning effort occurred in 1979. Follow-up poisoning at a maintenance level may be conducted to control prairie dog reinvasion.

Prey remains identified from regurgitated pellets were used to estimate Burrowing Owl food habits from April to October 1981. Fresh pellets were collected every two weeks or whenever visits were made to the study

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area. The accumulation of prey remains at nest sites also provided additional information on foods that did not show up in the pellets (Thomsen 1971).

All owl pellets were oven dried at 60 C for 48 hours, then weighed. Pellets were then placed in fine mesh nylon bags and agitated in warm water in a clothes washer until the pellets fell apart and all soluble material was cleared. The bags were then tumbled dry in a clothes dryer. This procedure was developed by Johnson and Hansen (1979) for the analysis of coyote (*Canis latrans*) feces.

Mammal remains were identified by hair characteristics (Moore et al. 1974) and/or comparison of teeth with reference materials. Feathers were identified to order using characteristics described by Day (1966). Reference materials were used to identify birds beyond order when possible. Arthropod remains were identified to family by comparison with insects and spiders collected from the area.

Owl food habits were quantified as percent frequency for each two-week collection, based on the number of items in the pellets, not the number of pellets examined. A two-way analysis of variance was used to test for differences among prey categories (mammals, birds, reptiles, and arthropods) and months. Tukey's method was used to determine which factors accounted for any differences.

RESULTS

Data on Burrowing Owl foods was obtained from 145 pellets. The mean dry weight of a pellet was 1.1 ± 0.4 grams. Arthropods accounted for the majority of items in owl pellets during each month of study, whereas mammals were the next most abundant prey item. Reptile remains were infrequent in the pellets, but vegetation was abundant. Vegetation in owl pellets was usually represented by small plant fragments, presumably originating from the stomachs of prey. However, large pieces of grass were also recovered (Table 1).

Mammal remains were most frequent in owl pellets in May, June, and July; then they decreased substantially ($P < 0.05$) in August and September. Arthropod remains became more frequent ($P < 0.05$) in the pellets in

conjunction with the decrease in mammals. No other significant differences were detected in Burrowing Owl food habits.

Prey remains that were found at nest burrows but did not show up in the pellets were Lark Bunting (*Calamospiza melanocorys*), great plains toad (*Bufo cognatus*), chorus frog (*Psuedocris triseriata*), unidentified fish, and tiger salamander (*Ambystoma tigrinum*).

DISCUSSION

Burrowing Owls in southwestern South Dakota consume a wide variety of animals and some vegetation. Most other studies have reported similar results (Robertson 1929, Hamilton 1940, Bond 1942, Thomsen 1971, Marti 1974, Gleason and Craig 1981). Although Burrowing Owls are reported to be primarily insectivorous (Earhardt and Johnson 1970), Gleason and Craig (1979) pointed out that, on a biomass basis, mammals may be more important. Thomsen (1971) found mammals to be more frequent than insects in Burrowing Owl pellets in California.

The shift in frequency of mammals and insects in owl pellets between the May-June-July and August-September periods was the biggest difference in owl food habits in this study. Diet diversity (H' , Shannon-Weiner index, Pielou 1975) did not differ by much between these two periods, 2.6 and 2.4, respectively, but diet breadth (Levins 1968) did, 4.7 and 2.1, respectively. Thus, owls consume a wider variety of prey during spring and early summer than during late summer and fall. Marti (1974) also reported a decrease in mammal consumption by Burrowing Owls in August and September. Errington and Bennet (1935) noted an increase in insect consumption in late summer and suggested that it was related to the fledging of young owls.

Burrowing Owl feathers were frequently found in the pellets examined. Earhardt and Johnson (1977) cited studies that have reported Burrowing Owls to be cannibalistic. In this study only one or two owl feathers were encountered in a pellet, and they were usually breast feathers, suggesting that the feathers were ingested while preening.

Although plant parts were found in almost every pellet examined, they were primarily small plant fragments from prey stomachs. In

TABLE 1. Mean percent frequency of occurrence¹ of foods found in pellets regurgitated by Burrowing Owls in Conata Basin, South Dakota.

Food item	Month				
	May	June	July	August	September
MAMMALS	12.5	9.9	12.2	1.2	5.5
<i>Peromyscus</i> spp.	7.8	3.1	5.8		2.5
<i>Sylvilagus floridanus</i>	2.7	0.4	1.2		
<i>Microtus ochrogaster</i>	0.5	0.4	0.6		0.5
<i>Spermophilus tridecemlineatus</i>	0.5	5.2	2.1		
<i>Perognathus</i> spp.	0.5				
<i>Geomys bursarius</i>	0.5	0.4			2.0
<i>Myotis</i> sp.			0.6		
<i>Cynomys ludovicianus</i>		0.4			
<i>Mus musculus</i>					0.5
Unidentifiable			1.9	1.2	
BIRDS	5.1	4.9	2.2	3.8	7.2
<i>Athene cunicularia</i> ²	3.6	1.9	1.0	3.8	6.7
<i>Eremophila alpestris</i>	0.5				
Passerine	0.5	2.6	1.2		
Unidentifiable	0.5	0.4			0.5
REPTILES		1.5		1.2	0.5
Lizard				1.2	
Snake		1.5			0.5
ARTHROPODS	54.0	50.2	53.9	70.9	63.6
Coleoptera					
Carabidae	16.6	7.4	9.5	12.7	11.1
Chrysomelidae			3.8		
Cincindelidae	0.5		0.6	10.0	
Coccinellidae	0.5				
Curculionidae	0.5		0.6	2.6	1.0
Histeridae	12.1	10.5	12.4	3.7	9.6
Scarabidae	6.2	0.4	2.5	1.4	
Silphidae	0.5	1.5	0.6	2.7	0.5
Tenebrionidae	2.1	11.2	7.9	16.9	12.0
Larvae					0.5
Diptera					
Larvae		0.4			
Hemiptera					
Unidentifiable		0.8			
Hymenoptera					
Formicidae	0.5	1.9	5.4	2.6	12.9
Ichneumonidae		2.3	2.3		
Proctotrupidae	0.5				
Sphecidae				1.4	
Unidentifiable		0.8			
Lepidoptera					
Larvae					1.0
Orthoptera					
Acrididae	10.9	2.7	1.8	16.9	12.5
Araneida					
Lycosidae	3.1	10.4	6.5		2.5
VEGETATION	16.3	18.9	18.5	19.2	15.5
Grass	0.5		3.1	1.2	
Plant fragments	15.8	18.9	14.8	18.0	15.5
Wood			0.6		
<i>Optuntia polyacantha</i> seed			0.6		
MISCELLANEOUS	12.1	14.6	12.6	3.7	7.7
Bone	12.1	14.2	12.6	3.7	7.7
Egg shell		0.4			

¹Based on number of items recovered from pellets.²Based on the occurrence of feathers in owl pellets. See Discussion.

some pellets we did find large pieces of grass and woody material that had been ingested directly by an owl. They could have been ingested during efforts to capture and kill prey. Thomsen (1971) also frequently found vegetation in Burrowing Owl pellets.

Because some items consumed by Burrowing Owls do not show up in the pellets, prey remains at nest sites must also be examined. Thomsen (1971) reported five prey items at nest sites that were not present in Burrowing Owl pellets. This absence could have at least two explanations: (1) it is not possible to find every pellet an owl produces, and (2) some foods or parts thereof may be completely digested. For example, we found that when Burrowing Owls ate great plains toads they typically placed the toad on its back and consumed the viscera and muscles of the legs, leaving the skeleton and other less digestible portions.

The similarity of Burrowing Owl food habits among this study and others reported in the literature indicates that possible poisoning of owl prey did not effect owl food habits.

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LITERATURE CITED

- AUFFORTH, A. K. 1981. The Burrowing Owl in North Dakota. North Dakota Outdoors. April 1981.
- BOND, R. M. 1942. Food of the Burrowing Owl in western Nevada. Condor 44: 183.
- COULOMBE, N. H. 1971. Behavior and population ecology of the Burrowing Owl, *Speotyto cunicularia*, in the Imperial Valley of California. Condor 73: 162-176.
- DAY, M. G. 1966. Identification of hair and feather remains in the gut and of stoats and weasels. Zool. Soc. London Proc. 148:201-217.
- EARHARDT, C. M., AND N. K. JOHNSON. 1970. Size dimorphism and food habits of North American Owls. Condor 72:251-264.
- ERRINGTON, P. L., AND L. J. BENNET. 1935. Food habits of Burrowing Owls in northwestern Iowa. Wilson Bull. 47: 125-128.
- GLEASON, R. L., AND T. H. CRAIG. 1979. Food habits of Burrowing Owls in southeastern Idaho. Great Basin Nat. 39:274-276.
- HAMILTON, W. J. 1940. A note on the food of the western Burrowing Owl. Condor 43:74.
- JOHNSON, M. K., AND R. M. HANSEN. 1979. Coyote food habits on the Idaho National Engineering Laboratory. J. Wildl. Manage. 43:951-955.
- LEVINS, R. 1968. Evolution in changing environments. Princeton Univ. Press, Princeton, New Jersey.
- MARTI, C. D. 1974. Feeding ecology of four sympatric owls. Condor 76:45-61.
- MARTIN, D. 1973. Selected aspects of Burrowing Owl ecology and behavior. Condor 75:446-456.
- MERRIAM, C. 1902. The prairie dog of the Great Plains. Pages 257-270 in United States Department of Agriculture Yearbook. Washington Government Printing Office, Washington, D.C.
- MOORE, R. D., L. E. SPENCE, AND C. E. DUGNOLLE. 1974. Identification of the dorsal guard hairs of some mammals of Wyoming. Wyoming Game and Fish Dept. Bull. 14.
- PIELOU, E. C. 1975. Ecological diversity. Wiley and Sons, New York, New York.
- ROBERTSON, J. 1929. Some observations on feeding habits of the Burrowing Owl. Condor 31:38-39.
- SPERRY, C. C. 1941. Burrowing Owls eat spadefoot toads. Wilson Bull. 53:45.
- THOMSEN, L. 1971. Behavior and ecology of Burrowing Owls on the Oakland Municipal Airport. Condor 73: 177-192.
- URESK, D. W., J. G. MACCRACKEN, AND A. J. BUGSTAD. 1982. Prairie dog density and cattle relationships. Pages 199-201 in Proceedings, 5th Great Plains Wildlife Damage Control Workshop. Lincoln, Nebraska.
- WHITNEY, N. R., B. E. HARRELL, B. K. HARNS, N. HOLDEN, J. W. JOHNSON, B. J. ROSE, AND P. F. SPRINGER. 1978. The birds of South Dakota. South Dakota Ornithologists' Union, Vermillion, South Dakota.