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FOOD OF BURROWING OWLS ON THE NORTHWESTERN KANSAS HIGH PLAINS

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Study of raptor food habits by analysis of regurgitated pellets is well known and the danger of false conclusions resulting from such data has been commented on by Craighead and Craighead (1969). However, for trend analysis and indication of some of the dietary components, such investigations are useful.

Analyses of Burrowing Owl (*Athene cunicularia*) pellets have been reported from a number of states—California (Thomsen 1971, Coulombe 1971); Nevada (Bond 1942); Iowa (Errington and Bennett 1935); Colorado (Longhurst 1942); and Florida (Lewis 1973). Earhart and Johnson (1970) reviewed the food habits of the Burrowing Owl, Robinson (1954) mentioned an instance of cannibalism by Burrowing Owls in Kansas, and Marti (1973) studied food consumption and pellet formation.

Burrowing Owls often use the burrows of prairie dogs (*Cynomys* spp.) for residence. It is unfortunate that the diet of Burrowing Owls on the Great Plains was not historically recorded as this was once an area of extensive prairie dog colonies and presumably high densities of Burrowing Owls (Bent 1938, Allen in Ely 1971:55). Our data can only hint of what must have been the original diet of Burrowing Owls on the High Plains.

Study Area and Methods

The study area was a black-tailed prairie dog (*C. ludovicianus*) colony of about 250 burrows, located in northwestern Kansas (Decatur County, T. 3S, R. 28W, Section 7). Prior to 1980, the colony had been in existence for more than 10 years and covered about 4 ha. of shortgrass prairie composed of predominantly buffalograss (*Buchloe dactyloides*), hairy (*Bouteloua hirsuta*) and sideoats (*B. curtipendula*) grammas, and western wheatgrass (*Agropyron smithii*). The main body of the colony was in a shallow draw that had scattered clumps of small soapweed (*Yucca glauca*) on the side hills and annual broomweed (*Gutierrezia dracunculoides*) scattered throughout. Only one tree, a large plains cottonwood (*Populus sargentii*) was near the colony. The prairie had been lightly to moderately grazed by cattle in the recent past. Cultivated land near the colony in 1980 was a summerfallow field about 300 m east of the colony's eastern periphery and a wheatfield about 600 m southwest of the colony's southern periphery.

The collecting of Burrowing Owl pellets began on 6 May 1980 and continued semi-monthly thereafter until 6 October. In May pellets were collected from the mouths of two burrows that housed pairs of owls, but in June and thereafter collections were from the single burrow that ultimately produced young.

Upon collection, pellets were placed in small plastic sackswith notes of collection date and field observations. Collections ($n=11$) ranged from 5-11 pellets ($\bar{x}=7.7$). Pellets were later removed and dried at 43°C for 72 hr. The average dry weight of pellets was 1.2g ($n=85$). Pellets were then disintegrated in 100% ethyl alcohol, segregated into basic components (insect and mammal remnants, grass, and sand) and again dried at 43°C for 72 hr. Once dry, components were again segregated, weighed ($\pm$ .01 g), and identified when possible. Grass and sand were excluded from final analyses since it was impossible to determine whether they had been pellet constituents or adherents.

Climatological data taken at the Oberlin station (about 3 km from the study area) were obtained from the Topeka forecast office of the National Weather Service (NOAA). We feel the data accurately represent climatological conditions for the study area.

Results

Analysis of pellet components showed a mid-summer shift in pellet constituency in terms of percent composition by weight (Figure 1). Prior to the 23 June collection the pellets were composed mainly of small animal remnants. Analyses of 3 July and 22 July collections showed similar amounts of small mammal and insect remnants. Collections from 7 August to 6 October were composed mainly of insect remains. Of the mammalian components identified, *Microtus ochrogaster* and *Peromyscus* spp. (probably deer mouse, *P. maniculatus*) remnants occurred most often (Table 1). Remnants of harvest mice (*Reithrodontomys* sp.) were identified twice and pocket mouse (*Perognothus* sp.) remnants were identified in

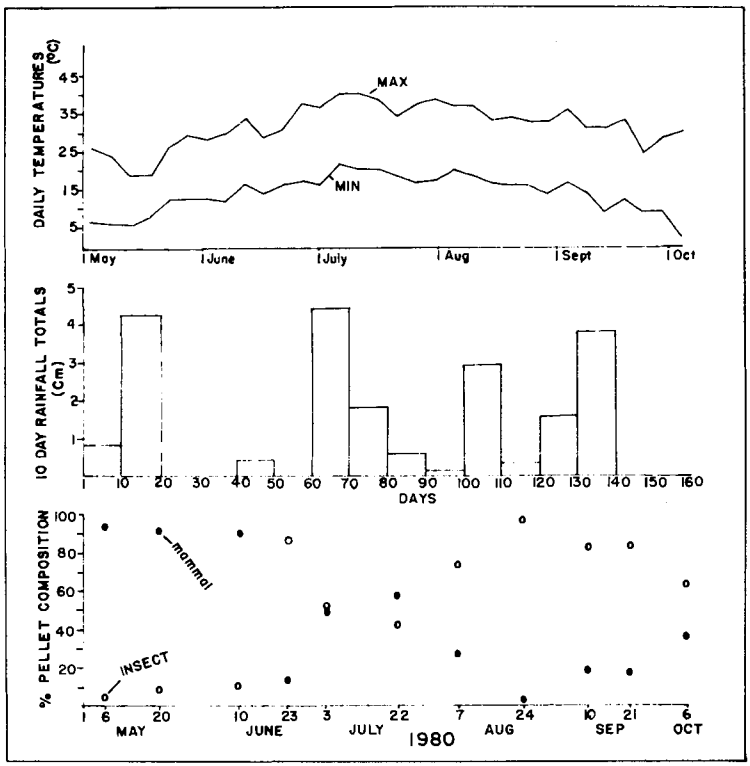

Figure 1. The percent of pellet composition (dry weight in grams) of mammal and insect remnants, the 10 day cumulative rainfall totals, and the 5 day averages of minimum and maximum temperatures for a study site on the Kansas High Plains.

one sample. The only non-rodent remains identified were those of a cottontail (*Sylvilagus* sp.) in the 10 September sample.

Of the insect remnants identifiable, three families of beetles (*Coleoptera*) and one grasshopper (*Opthoptera*) family were identified (Table 1). Two beetles (*Phaneus vindex*: Scarabaeidae and *Nicrophorus marginatus*: Silphidae) were found most often and the former occurred in most of the samples. Pellets from the July and August samples contained evidence of many species of the smaller dung (*Scarabaeidae*) beetles (*Copris* spp., *Aphodius* spp., and *Ataenius* spp.). The only Carabid beetle identified was *Pasimachus depressus*. From 3 July to 10 September

grasshoppers (mainly *Pardalophora* spp. and *Melanoplus* spp.) comprised most of the insect remnants.

Field notes documented that on 6 May only one pair of owls was in residence. On 10 June two pairs were noted and on 23 June three pairs were observed. The two active burrows were approximately 75 m apart. Only the original pair (6 May) of owls succeeded in fledging young. The other two pairs were not observed after 23 June. On 22 July four juvenile Burrowing Owls were observed at the entrance of the nest burrow. Thereafter, never more than three juveniles were noted. On 21 September and 6 October only one adult was observed. No Burrowing Owls were observed after 6 October.

Discussion

According to many (Bent 1938, Errington and Bennett 1935, Longhurst 1942, Coulombe 1971, Thomsen 1971, and Lewis 1973) Burrowing Owls are opportunistic carnivores, and to a lesser extent, scavengers. Based on reports in the literature, Earhart and Johnson (1970) contended that Burrowing Owls foraged primarily on arthropods, but if biomass is the measure of predation, their conclusions are debatable. Our 1980 study indicated that Burrowing Owls were somewhat stenophagous on the Kansas High Plains when compared to the prey diversities reported in other studies. This may be because the short-grass prairies have a less diverse prey fauna available, or more likely it was an artifact of our small sample size.

In the early summer samples we found a major shift from small rodent remnants to insect remnants as measured by weight of pellets. Thomsen (1971) found just the opposite in her study of Burrowing Owl ecology on a California airport but noted that grasshoppers were an inconsequential part of the owls' diets. In northwestern Iowa, Errington and Bennett (1935) found a change similar to ours except that it occurred much later (mid-August). They speculated that young owls were foraging for themselves for the first time and were not sufficiently adept to catch vertebrate prey. The insect remnants in the pellets represented the young owls feeding on more easily captured insects.

We do not believe juvenile owls were foraging for themselves during the June-July diet change. If not, what prompted the change in adult owl predatory behavior?

The climatological data portrayed in Figure 1 offer no clues for a change in environmental conditions prompting a change in predatory behavior. Temperatures remained fairly constant during this period as did precipitation except for sporadic thunderstorms.

Coulombe (1971) stated that Burrowing Owls are primarily crepuscular in foraging. However, Thomsen (1971), Bendire (in Bent 1938), and observations by one of us (RL) in South Dakota concluded that Burrowing Owls are mainly nocturnal foragers during the summer months. It seems probably that the small rodents would have been most active at night. It may be that the rodents changed their activity patterns which in turn decreased their vulnerability to Burrowing Owl predation. The owls then had to turn to insects as an alternate food source.

Another possibility is that insect behavior and/or abundance changed, making them more vulnerable to owl predation. Except for the slight increase in small dung beetle remnants found in mid to late summer samples, the quantity and diversity of beetles in the pellets remained more or less static. Grasshopper remnants, however, did change suddenly and drastically. It may be that grasshopper populations in the study area suddenly increased and the owls shifted to a more plentiful prey. Otteni, *et al* (1972) found that type of prey offered to nestling Barn Owls (*Tyto alba*) closely followed prey population trends. Unfortunately, we did not monitor prey populations in the study area.

Yet another explanation might be that a shift in prey occurred because of a change in the predator's energy needs. Jarvis and Southern (1976) found Ring-billed Gulls (*Larus delawarensis*) supplemented their fish diet with aquatic, terrestrial, and aerial invertebrates, especially when feeding young. Walsh (1978) reported the quality and quantity of food offered to nestling Purple Martins (*Progne subis*) changed in part with nestling age. When Hardy (1976) compared

the diets of the Bushy-crested Jays (*Cyanocorax melanocyanea*) and San Blas Jays (*C. sanblasiana nelsoni*), he found adults of the former foraged on insects and fruit but young were fed only insects. However, San Blas Jays supplemented the adult diet of insects and lizards with fruit for feeding young. Length of the nestling period does not appear to be reported for Burrowing Owls. By inference from

Table 1. Small mammal and insect remnants identified in Burrowing Owl pellets from 6 May to 6 October, 1980 at a location on the northwestern Kansas high Plains. x = present, - = absent.

	May		June		July		Aug.		Sept.		Oct.
Mammals	6	20	10	23	3	22	7	24	10	21	6
Order Rodentia											
Family Cricetidae											
Microtus spp.	-	x	x	x	x	x	x	-	-	-	x
Peromyscus spp.	x	x	x	x	-	-	-	x	x	x	x
Reithrodontomys spp.	-	x	-	-	x	-	-	-	-	-	-
Family Heteromyidae											
Perognathus spp.	-	-	-	-	-	x	-	-	-	-	-
Order Lagomorpha											
Family Leporidae											
Sylvilagus spp.	-	-	-	-	-	-	-	-	x	-	-
Insects											
Order Coleoptera											
Family Carabidae	-	-	x	-	-	x	-	x	-	x	x
Family Scarabaeidae	-	x	x	x	x	x	x	-	x	x	-
Family Silphidae	x	x	-	x	-	x	-	-	x	-	-
Order Orthoptera											
Family Acrididae	-	-	-	x	x	x	x	x	x	x	x

nestling period durations known for other species of owls (Harrison 1978), this period for the Burrowing Owl is probably 3-5 weeks. Juveniles in this study were first observed on 22 July. This may indicate that the eggs hatched in mid to late June.

The sudden appearance of grasshopper remnants in the pellets was first found in the 23 June sample, and the change from mostly rodent to mostly insect remnants (23 June-7 August) may indicate that the adults shifted to a more plentiful and-or easily captured prey to meet the nutritional needs of the nestlings. The continued high incidence of insect remnants in the collections after 7 August may be as Errington and Bennett (1935) speculated, juvenile owls preying on a plentiful and easily captured prey. The increase in small mammal remnants late in the study period (10 September-6 October) might indicate maturity of the juveniles' hunting skills or perhaps the adults were once again foraging solely for themselves.

Summary

Pellets from a family of Burrowing Owls were collected 6 May to 6 October 1980 from a study site on the Kansas High Plains. Analysis showed the diet to be somewhat more stenophagous than diets reported from other studies. This was hypothesized to be a reflection of limited prey diversity on the High Plains.

The main component of pellets shifted dramatically from primarily rodents to primarily insects in the 23 June sample and thereafter. Explanations proposed for this were a change in rodent behavior, a change in grasshopper abundance, or a change in adult Burrowing Owl predatory behavior.

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Hail Damage to Breeding Birds and their Nests on the Konza Prairie Research Natural Area. Spring and summer thunderstorms cause much damage each year. Many anecdotal accounts of harm to adult birds have been recorded (see review by Piehl, J. L. 1979. Avian mortality from a severe hail storm. Prairie Naturalist 11:75-779. Johnson (1979. Effects of a summer storm on bird populations. Prairie Naturalist 11:78-82) censused areas damaged by a major hail storm and compared bird populations to area undamaged by the storm, estimating deaths due to the storm at about 50,000 birds for Stutsman County, North Dakota. Neither Piehl nor Johnson surveyed nests, eggs or nestlings, but suggested that losses might be substantial. This report documents damage caused by high winds and hail to breeding birds and their nests on Konza Prairie Research Natural Area about 12 km south of Manhattan, KS in Riley and Geary Counties. The Konza and adjoining areas were hit with a major storm on Monday morning 7 June 1982 at approximately 0340. The storm lasted about 45 minutes dumping "golf ball-size" hail and contained winds of up to 90 miles per hour.

Nests in trees near the headquarters buildings of Konza Prairie and ground nests in the southwest part of Konza had been surveyed prior to the storm as part of on-going studies on prairie bird populations. These nests were visited after the storm to assess storm damage.

Of the three Common Grackle (*Quiscalus quiscula*) nests near headquarters, one nest was destroyed by the storm, killing two nestlings. Two of two Mourning Dove (*Zenaida macroura*) nests were also destroyed. In one case, the parent and

two 4-day old squabs were killed, while in the other a parent and two eggs were destroyed.

There were six known ground nests in the southwest part of Konza. Of these, two Common Nighthawk (*Chordeiles minor*) nests were destroyed. In one case the parent was killed and two eggs were left unhatched, while in the other nest, two eggs were broken and the parent was unharmed. Two Mourning Dove nests had dead squabs, one was four days old, the other three. Both nests had unbroken eggs that were subsequently abandoned. Two Mourning Dove nests near forbs were unaffected by the storm. One nest had 8-day old squabs and the other had eggs.

Most of the Upland Sandpiper (*Bartramia longicauda*) nests had fledged young prior to the storm. However, I did notice one dead young and a parent with a broken wing on the main trail of Konza. This parent was subsequently eaten by a coyote.

There were no known forb or grass nesting birds within my study sites, but I did notice a Grasshopper Sparrow (*Ammodramus savannarum*) with a broken neck near one of the jeep trails on Konza.

Recovery by those surviving the storm is rapid. Dickcissel (*Spiza americana*), Grasshopper Sparrow and Eastern Meadowlark (*Sturnella magna*) males were singing later that morning. Four days after the storm, I found a Mourning Dove nest with two eggs.

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