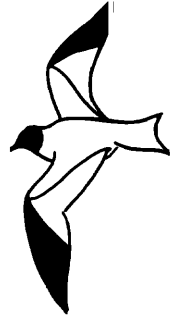


WESTERN BIRDS



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DIETS OF FIVE SPECIES OF DESERT OWLS

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Common Barn-Owls (*Tyto alba*), Great Horned Owls (*Bubo virginianus*), Long-eared Owls (*Asio otus*), Western Screech-Owls (*Otus kennicottii*), and Burrowing Owls (*Athene cunicularia*) all occur as year-round or seasonal residents of southern California deserts. This species richness provided me an opportunity to compare the diets of these owls both within and between desert regions. Within-region comparisons allowed analyses in situations where all owl species had access to the same prey base, eliminating differential prey availability as a factor. Interspecific differences under these conditions might then be due to differences in predatory behavior or prey preferences. Additionally, I was able to follow month-to-month variation in diets of three sympatric owl species to determine if their dietary fluctuations were synchronous or independent.

STUDY AREA AND METHODS

Diets were determined from the contents of regurgitated pellets found below the owls' diurnal roosts or burrow entrances. With the exception of one Long-eared Owl sample from Anza-Borrego State Park in 1980, the pellets were collected from December 1985 through the summer of 1988. Unless otherwise noted, the collections represent one visit to each site.

A few sites were occupied nearly continuously, allowing temporal analysis of their inhabitants' diets. These roosts were located primarily in the Coachella Valley Preserve, a 5260-ha natural area in Riverside Co., California (0 to 100 m elevation). This area is in the Colorado Desert subdivision of the Sonoran Desert (Jaeger 1957) and is dominated by Creosote Bush (*Larrea divaricata*) scrub and scattered Desert Fan Palm (*Washingtonia filifera*) oases. Thousand, Horseshoe, Indian, and Biskra Palms are found within this preserve. Other samples from within the Coachella Valley were taken at the University of California's Boyd Deep Canyon Research Center and Seven Palms oasis. Except for those of Burrowing Owls, 85% of these samples were collected in Desert Fan Palm oases. All these collection sites were dominated by natural vegeta-

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tion. For comparison, pellets were also gathered in areas that included irrigated farmlands and downtown Indio.

Additional sites outside the Coachella Valley but within the Colorado Desert included two locations near the SE shore of the Salton Sea, Imperial Co. (-65 m elevation, Common Barn-Owl and Great Horned Owl), in the Orocopia Mountains, Riverside Co. (300 m elevation, Common Barn-Owl), at Yaqui Well in Anza-Borrego State Park, San Diego Co. (300 m elevation, Long-eared Owl) and in Chemehuevi Wash, San Bernardino Co. (200 m elevation, Long-eared Owl).

Three sites occupied by Common Barn-Owls were at intermediate elevations (650-900 m) and supported vegetation common to both the Colorado and Mojave deserts. These sites included the Oasis of Mara in Twentynine Palms and Morongo Valley, both in San Bernardino Co., along with a location near Corn Spring, Riverside Co.

The Mojave Desert sites (1000 to 1600 m elevation) were dominated by Joshua Trees (*Yucca brevifolia*) and Mojave Yucca (*Y. schidigera*). Common Barn-Owl diet samples were collected near Cima Dome and in the Lanfair Valley, San Bernardino Co., and at Devil's Punch Bowl, Los Angeles Co. A Long-eared Owl diet sample was collected near China Lake, Kern Co. Locations of all sites are shown in Figure 1.

RESULTS

Species Accounts

COMMON BARN-OWL. This year-round resident was commonly found roosting in palm oases, mine addits, and cliffs. At all sites sampled within the Colorado Desert, pocket mice (*Perognathus* sp.) were the most common prey in Common Barn-Owl diets (Table 1). This pattern held both between sites and between years (at Thousand Palms Oasis), indicating a regional diet similarity. In the Mojave Desert, and at two of the sites at intermediate elevations, kangaroo rats (*Dipodomys* sp.) dominated this owl's diet, again showing a regional similarity. Common Barn-Owl diets from Morongo Valley varied between years from a preponderance of pocket mice to a nearly equal proportion of pocket mice and kangaroo rats, illustrating Morongo's intermediate position. Irrigating or urbanizing the desert appears to result in an increased frequency of rodents adapted to mesic conditions in the owls' diet. House Mouse (*Mus musculus*) and Pocket Gopher (*Thomomys bottae*) remains became more abundant, while pocket mice and especially kangaroo rats were reduced.

Despite diet similarities within regions and within habitats, there was a high degree of month-to-month variation at Thousand Palms Oasis (Figure 2). Throughout my study, the frequency by month of pocket mice or kangaroo rats varied from above 70% to near 0%.

LONG-EARED OWL. These owls are primarily winter residents; most arrive in October through December and leave the area by March. However, a few stay to breed, with records from Yaqui Well and Morongo Valley. These owls occasionally roost in palms, but were more common in Palo Verde (*Cercidium floridum*), Ironwood (*Olneya tesota*), and tamarisk (*Tamarix* sp.) trees in oases or desert washes.

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Pellet analyses indicated temporal shifts in Long-eared Owl prey selection (Table 2). Diets from the Coachella Valley, in the winter of 1985-86, were dominated by pocket mice (52%); in 1986-87 kangaroo rats predominated (72%); in 1987-88 pocket mice again dominated (67%). All sites and years combined, this owl and Common Barn-Owls from the Colorado Desert had the highest percentage of similarity, 89%, of any owl species pair in this study. Percentage of similarity is the sum of the smaller frequencies in all prey categories for the two diets being compared (Brower and Zar 1977). The result of this comparison indicates that these owls have similar prey selection capabilities. However, month-to-month comparisons of adjacent Common Barn-Owls and Long-eared Owls at Thousand Palms (Figure 2) revealed striking differences in their temporal patterns of predation on pocket mice.

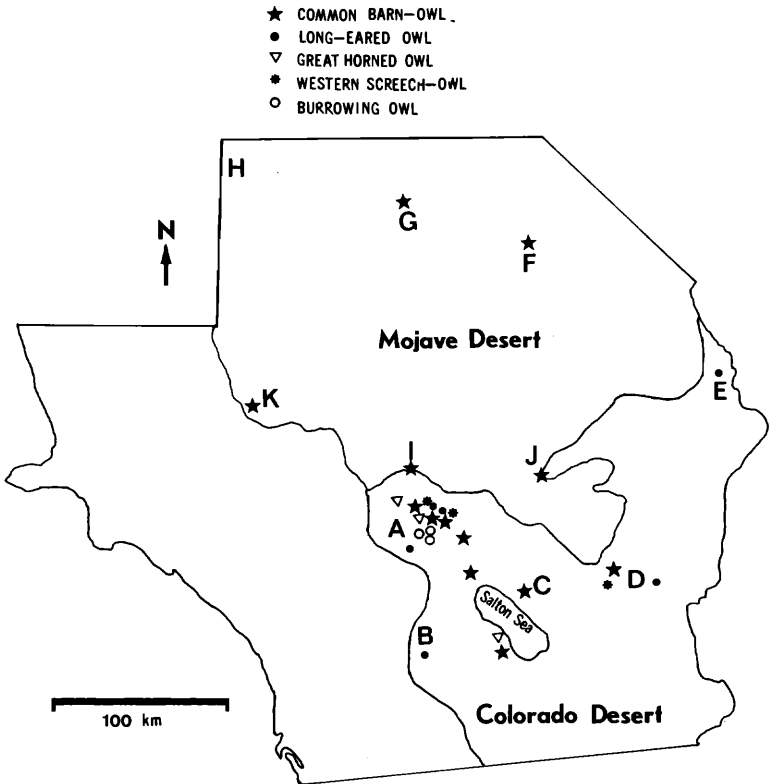


Figure 1. Sites where owl pellets were collected. A = Coachella Valley; B = Anza-Borrego State Park; C = Orocopia Mountains; D = Corn Spring/Chuckwalla Mountains; E = Chemehuevi Wash; F = Lanfair Valley; G = Cima Dome; H = China Lake; I = Morongo Valley; J = Twentynine Palms; K = Devil's Punchbowl.

4 **Table 1** Percentages of Prey in the Diets of Common Barn-Owls in the Southern California Deserts

Prey	Salton Sea Basin				Coachella Valley Natural Habitats					
	Salton Sea	Orocopia Mountains	Horseshoe Palms	Biskra Palms	Tyler Rd. Palms	Edom Hill	Thousand Palms			
							1985	1986	1987	1988
Ground squirrels (<i>Spermophilus</i> sp.)	0	0	0	0	0	0	0	0	0	0
Audubon's Cottontail (<i>Sylvilagus audubonii</i>)	0	0	0	0	0	0	0	0	0	0
Woodrats (<i>Neotoma</i> sp.)	0	6	3	7	6	12	4	2	5	18
Pocket Gophers (<i>Thomomys bottae</i>)	19	12	3	19	10	1	10	7	11	6
Kangaroo rats (<i>Dipodomys</i> sp.)	8	10	7	24	12	40	31	24	32	15
Pocket mice (<i>Perognathus</i> sp.)	72	68	79	31	45	57	45	60	46	50
Deer mice (<i>Peromyscus</i> sp.)	0	2	4	7	7	0	6	3	5	6
House mice (<i>Mus musculus</i>)	0	0	3	7	20	0	0	1	+	3
Voles (<i>Microtus</i> sp.)	0	+	0	0	0	0	0	0	0	0
Harvest mice (<i>Reithrodontomys</i> sp.)	0	0	0	0	0	0	0	0	0	0
Desert Shrew (<i>Notiosorex crawfordi</i>)	0	0	0	0	0	0	0	0	0	+
Birds	0	0	0	5	0	0	0	0	0	+
Arthropods	0	0	0	0	0	0	2	+	1	1
No. of prey items	57	233	67	42	138	47	51	255	401	350

^a + indicates a frequency of less than 1%.

Table 1 (Continued)

Prey	Coachella Valley Disturbed Habitats			Intermediate Elevations		Mojave Desert			
	Indio	Farmland	Corn Spring	Twenty-nine Palms	Morongo		Cima Dome	Lanfair Valley	Devil's Punchbowl
					1987	1988			
Ground squirrels (<i>Spermophilus</i> sp.)	0	0	0	0	1	0	0	0	3
Audubon's Cottontail (<i>Sulvilagus audubonii</i>)	0	0	0	0	1	1	0	0	0
Woodrats (<i>Neotoma</i> sp.)	0	2	9	2	4	2	20	24	7
Pocket Gophers (<i>Thomomys bottae</i>)	32	48	0	0	7	6	4	6	26
Kangaroo rats (<i>Dipodomys</i> sp.)	0	0	51	74	25	36	54	54	51
Pocket mice (<i>Perognathus</i> sp.)	36	26	31	22	38	35	10	6	0
Deer mice (<i>Peromyscus</i> sp.)	5	0	9	2	14	10	11	6	7
House mice (<i>Mus musculus</i>)	22	17	0	0	0	0	0	0	0
Voiles (<i>Microtus</i> sp.)	0	0	0	0	4	3	0	0	7
Harvest mice (<i>Reithrodontomys</i> sp.)	0	0	0	0	3	0	0	0	0
Desert Shrew (<i>Notiosorex crawfordi</i>)	0	0	0	0	1	1	0	0	0
Birds	1	0	0	0	0	2	0	0	0
Arthropods	2	2	0	0	3	2	0	0	0
No. of prey items	85	42	57	55	271	94	130	63	31

6 **Table 2** Percentages of Prey in the Diets of Long-eared Owls in the Southern California Deserts

Prey	Coachella Valley											
	Anza-Borrego		Chemehuevi		China		Chuckwalla		Thousand Palms			
	Yaqui Well	Wash	Lake	Mountains	1985	1986	1987	1985	1986	1987	Deep Canyon	
<i>Sylvilagus audubonii</i>	0	0	0	0	0	0	0	0	0	0	0	0
<i>Neotoma</i> sp.	4	3	6	0	0	0	0	4	3	9	+	1
<i>Thomomys bottae</i>	1	0	9	0	0	0	0	0	0	0	+	0
<i>Dipodomys</i> sp.	52	55	26	10	52	6	24	37	65	15	65	65
<i>Perognathus</i> sp.	18	42	23	80	48	88	69	54	26	70	27	27
<i>Microtus californicus</i>	1	0	0	0	0	0	0	0	0	0	0	0
<i>Peromyscus</i> sp.	18	0	35	0	0	0	1	2	2	3	7	7
<i>Notiosorex crawfordi</i>	3	0	0	0	0	0	0	0	0	0	0	0
Bats	1	0	0	0	0	0	0	0	0	0	0	0
Birds	0	0	0	0	0	0	0	0	0	0	0	0
Arthropods	0	0	0	0	0	0	0	2	2	1	+	0
No. of prey items	66	31	34	10	25	17	29	46	127	496	75	75

^a + indicates a frequency of less than 1%.

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GREAT HORNED OWL. This resident owl was regularly found in two palm oases I surveyed in the Coachella Valley. An additional pair was in an abandoned building on the SE shore of the Salton Sea.

Great Horned Owls selected the broadest range of prey sizes of any of the species considered here, taking large numbers of Audubon Cottontails (*Sylvilagus audubonii*) and woodrats (*Neotoma* sp.) along with arthropods, especially scorpions (Table 3). Overall diets of Great Horned Owls in the Coachella Valley had a moderate percentage of similarity with Common Barn-Owls (66%) and Long-eared Owls (65%) from the same region.

WESTERN SCREECH-OWL. Western Screech-Owls are year-round residents of the palm oases. Large pellet accumulations were located in three oases, although a few screech-owl pellets were found in almost every palm oasis examined. This owl's diet seems to reflect the availability of prey in and around the palms (Table 3). Deer mice (*Peromyscus* sp.) and Spiny Pocket

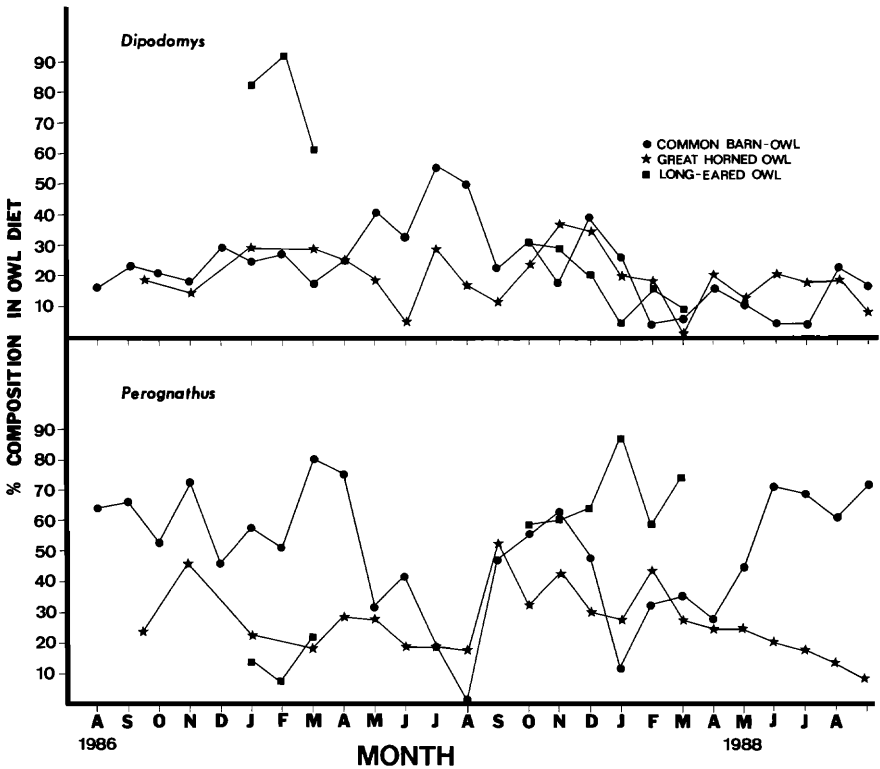


Figure 2. Monthly frequencies of kangaroo rats and pocket mice in the diets of three owl species in the Coachella Valley.

∞ **Table 3** Percentages of Prey in the Diets of Great Horned Owls, Western Screech-Owls, and Burrowing Owls in the Colorado Desert

Prey	Great Horned Owl				Western Screech-Owl			Burrowing Owl			
	SE Salton Sea	Seven Palms	Indian Palms		Thousand Palms	Biskra Palms	Corn Spring	Coachella Valley			
			1986	1987				1988	A	B	C
<i>Syrrhaptes audubonii</i>	13 ^a	2	0	2	0	0	0	0	0	0	0
<i>Neotoma</i> sp.	26	21	12	18	0	0	0	5	0	0	0
<i>Thomomys bottae</i>	2	3	3	1	0	0	0	0	2	0	2
<i>Dipodomys</i> sp.	26	28	18	24	13	0	0	0	8	18	13
<i>Perognathus</i> sp.	5	29	29	28	25	20	30	35	4	29	17
<i>Peromyscus</i> sp.	0	3	3	+ ^b	2	13	35	0	0	0	0
<i>Mus musculus</i>	0	0	0	0	0	2	0	0	0	0	0
Bats	0	0	0	0	2	0	0	0	0	0	0
Birds	8	0	1	+	1	0	5	1	0	0	0
Reptiles	0	1	1	8	0	0	0	0	0	0	5
Insects	10	10	4	2	40	58	10	75	53	54	54
Scorpions	10	2	29	14	1	7	15	9	0	0	9
Crayfish	0	0	0	0	2	0	0	0	0	0	0
No. of prey items	39	120	66	342	90	45	20	122	17	78	78

^aMay include some Black-tailed Jackrabbits (*Lepus californicus*).

^b+ indicates a frequency of less than 1%.

Mice (*Perognathus spinatus*) are especially numerous in palm oases (pers. obs.); their abundance appears to be reflected in the Western Screech-Owl's diet.

BURROWING OWL. This year-round resident was the only species considered in this study that was not at least partly associated with palm oases. Burrowing Owls are the most insectivorous of the five owl species (Table 3); one of their most common prey was earwigs (Dermaptera).

The similarly sized Burrowing Owl and Western Screech-Owl were the most allopatric of any species pair considered here; the percentage of similarity in their diets was 67%. Burrowing Owls were found lower on the alluvial fans, far from the palm oases.

Two Common Barn Owl roosts, a Great Horned Owl roost, and a Long-eared Owl communal roost (the number of owls varied between 2 and 15) were in use regularly enough to allow a monthly diet analysis (Figure 2). These roosts were about 1 km apart, separated by a large wash that was a likely hunting area for all three species. Over the 21-month study, there was little if any similarity in the frequencies of pocket mice taken by the owl species. The frequency oscillations of kangaroo rats in the diets of Common Barn-Owls and Great Horned Owls, the species pair with the most similar diet fluctuations for this prey, were synchronous only 65% of the time.

DISCUSSION

Regional and habitat-related similarities of Common Barn-Owls in the Colorado and Mojave Deserts lend support to a hypothesis that owls' diets are a direct reflection of prey availability (Errington 1932). Dietary differences between the high and low deserts may be explained in part by the limited seasonal availability of pocket mice in the Mojave Desert. In the Mojave, the most common pocket mouse, *Perognathus longimembris*, hibernates during the winter months (Ingles 1965) and is therefore unavailable to the owls much of the year. The Colorado Desert has more pocket mouse species (Ingles 1965), many of which are active year round. These pocket mice are available in all seasons and are an integral part of the Common Barn-Owl's diet. Similarly, woodrat lodges were observed to be much more abundant within the ranges of those Common Barn-Owls in the Mojave Desert that took a high percentage of this rodent in their diets.

Other studies have also documented a correlation between prey availability and owl diets. Schwartz and Bleich (1985) found that the proportions of prey species in the diets of Common Barn-Owls at two California locations roughly matched the frequencies of those prey in the surrounding environment. While their data is suggestive of Common Barn-Owl predatory patterns, they did not provide a temporal analysis to determine whether the owls actually tracked prey availability. Broad temporal relationships were reported by Evans and Emlen (1947), Fitch (1947), and Marti (1974). These studies documented the seasonal availability of certain prey matching their occurrence in the owl diets; again, they didn't examine the tendency of owls to track the abundance of those prey.

In my analysis, I compared the diets of three owl species hunting over the same time and space to interpret predation patterns. The overall similarity

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in the diets of Long-eared Owls, Common Barn-Owls, and, to a lesser extent, Great Horned Owls indicates similar predatory capabilities and predilections.

Month-to-month comparisons of the three owl species' predation on pocket mice, the most common prey (overall) for each species, indicated no consistent tracking of availability. For Common Barn-Owls and Long-eared Owls, there were striking differences between the monthly rates of predation on pocket mice and to a lesser extent on kangaroo rats. The large proportion of kangaroo rats in many Long-eared Owl pellets (during the winter of 1986-87) from the Coachella Valley confirm that these rodents were available to Common Barn-Owls. Yet, during that period, barn-owls took approximately twice as many pocket mice as kangaroo rats, even when kangaroo rats constituted as much as 72% of neighboring Long-eared Owls' diets.

Geographic and habitat-related patterns in desert owl diets can be explained by prey availability. However, prey availability alone appears to fall short of explaining the monthly variation of the owl diets reported here. Selective predation appears likely, and competitive interference and differences in habitat selection may have influenced the observed diets.

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Pete Bloom, Bob McKernan, and Allan Muth aided in locating Long-eared Owl pellets. Katherine Barrows, Pete Bloom, Mark Fisher, Tim Manolis, Allan Muth, Bruce Webb, and Jon Winter offered suggestions to improve drafts of my manuscript. The Nature Conservancy, Bureau of Land Management, Joshua Tree National Monument, U.S. Fish and Wildlife Service, California Department of Fish and Game, and Boyd Deep Canyon Research Center generously allowed access to their facilities and land.

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The following article is the third in a series on California rarities edited by Morlan and Roberson. It is based on materials submitted to the California Bird Records Committee (CBRC). The description and circumstances were edited from the accounts of the observers and have been reviewed by them. Roberson prepared the distributional summary and Morlan prepared the identification summary. In this way we hope that much important information accumulated in CBRC files will become widely available.



Common Black-Hawk

Sketch by Tim Manolis

FIRST RECORD OF THE COMMON BLACK-HAWK FOR CALIFORNIA

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On 13 April 1985, Daniels and the Hayses found a Common Black-Hawk *Buteogallus anthracinus* at Thousand Palms Nature Conservancy Preserve, Riverside County, California, a lush California Fan Palm *Washingtonia filifera* oasis with a creek lined by Fremont Cottonwoods *Populus fremontii*. They first saw the hawk at 0700 flying downstream about 50 yards away. A Common Raven *Corvus corax* whose nest was nearby harassed it. The hawk flew back over the observers (within about 50 feet) and disappeared into the palm trees. At about 0800 they saw it again about a half mile upstream. It flew past them and then circled higher and higher, disappearing toward the north. They observed the bird for a total of about 15 minutes. Efforts to follow it by car were unsuccessful. They, and others, searched for the hawk later that day, but did not find it.

The following description was compiled from those of the three observers:

A buteonine hawk about the size of a Red-tailed Hawk *Buteo jamaicensis* (not directly compared but soaring in the same general area) but differing by its very broad rounded wings and short wide tail. It was perhaps the same length as the adjacent raven but was noticeably bulkier and soared with a flat flight profile.