

SEASONAL VARIATION IN THE DIET OF THE BARN OWL IN NORTHWESTERN NEVADA

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ABSTRACT: The Barn Owl (*Tyto alba*) is a widespread predator of small mammals that is declining in many parts of its range. We analyzed the Barn Owl's diet at Stillwater National Wildlife Refuge, Churchill County, Nevada, by identifying remains in pellets collected during the summer (May–September 2007) and winter (October 2007–February 2008). In 306 pellets (143 from summer, 163 from winter), we identified 796 vertebrate prey items including 9 genera of mammals and several species of birds. At both seasons, mammals, primarily of the genera *Microtus* (voles), *Peromyscus* (white-footed mice), *Reithrodontomys* (harvest mice), and *Dipodomys* (kangaroo rats) were found in >93% of pellets. Bird remains were found in 15.5% and 11.1% of pellets in summer and winter, respectively. Remains of giant water bugs (family Belostomatidae) were present in 7.7% of summer pellets but absent in winter. Although the diet was dominated by the same five categories of prey (four mammal genera and birds) at both seasons, the proportions of *Microtus* and *Peromyscus* declined during the winter, while those of *Reithrodontomys* and *Dipodomys* increased.

Regurgitated pellets have commonly been used to examine the composition of and both spatial and temporal variation in the diet of owls. The Barn Owl (*Tyto alba*) has been the subject of many diet studies owing to its broad distribution in North America, concern over its declining numbers in some regions, and its tendency to nest in artificial sites (e.g., buildings or nest boxes) that allow easy collection of pellets (Marti 1992). Most studies have found that small mammals, particularly rodents and shrews, dominate the Barn Owl's diet, although the primary prey species vary substantially both by location (reviewed in Marti 1992) and by season or year at a single location (Otteni et al. 1972, Smith et al. 1972, Marti 1973, 1988, Franzreb and Laudenslayer 1982, Gubanyi et al. 1992).

We studied the diet of the Barn Owl at the Stillwater National Wildlife Refuge in northwestern Nevada during both summer and winter. Although the Barn Owl's diet is well studied in some regions of North America, little information on it is available for the Great Basin of Nevada, a region where populations appear to be relatively stable (Floyd et al. 2007). The only two published accounts of the owl's diet in Nevada were based on 89 (Alcorn 1942) and 14 (Bogiatto et al. 2006) pellets. Our objective was to describe the composition of this Barn Owl population's prey and to evaluate if the diet varied seasonally.

METHODS

We collected pellets from six sites in or near Stillwater National Wildlife Refuge within Churchill County, Nevada. The sites were centered primarily on nest boxes that the owls used for breeding in summer and roosting in winter, except for one in the attic of a deserted building. Prior to our study,

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pellets had been regularly removed from these sites, so that the “summer” pellets we collected were deposited between May and September 2007, the “winter” pellets between October 2007 and February 2008. The surrounding landscape consisted of a mixture of agricultural fields of alfalfa (*Medicago sativa*) and other hay crops and upland desert scrub dominated by black greasewood (*Sarcobatus vermiculatus*) and four-wing saltbush (*Atriplex canescens*). Irrigation ditches with cattails (*Typha* spp.) were present at all sites, often with associated stands of Fremont cottonwood (*Populus fremontii*). One site was near several large lakes edged by marshes of cattails and tule (*Scirpus* spp.).

Before dissecting them, we dried the pellets for ~1 hr at 150° C to kill potential pathogens and then weighed them. We dissected the pellets by standard methods, identifying skull remains to the genus or species level by means of skull keys and a reference collection of local species. For each species, we used the maximum count of crania, left dentaries, or right dentaries to determine the number of individuals in each pellet. Finally, we used G tests of independence to determine if the proportional importance of each of the five most abundant categories of prey differed by season.

RESULTS

We identified 387 individual items of vertebrate prey in 143 summer pellets (total dry mass of all pellets, 1.004 kg) and 409 prey items in 163 winter pellets (total dry mass, 1.035 kg). We found mammal remains in 135 summer pellets (94%) and 152 winter pellets (93%) and identified seven genera of mammals in summer pellets and eight genera in winter pellets (Table 1). We found bird remains in 15.5% and 11.1% of pellets in summer and winter, respectively. We were unable to identify all bird remains to family or species, but several skulls were of icterids, likely the Red-winged (*Agelaius phoeniceus*) or Yellow-headed (*Xanthocephalus xanthocephalus*) blackbirds, or sparrows (family Emberizidae), and one pellet contained the legs of a small rail, probably a Sora (*Porzana carolina*). Although we found some insect parts in association with bird remains, particularly within gizzards, we identified the remains of giant water bugs (family Belostomatidae, likely *Lethocerus americanus*) independent of bird remains in 7.7% of summer pellets, suggesting that the owls occasionally targeted these large insects as prey.

During both summer and winter, the diet of this owl population was dominated by the same 5 categories of prey; voles (*Microtus* spp.), white-footed mice (*Peromyscus* spp.), harvest mice (*Reithrodontomys* spp.), kangaroo rats (*Dipodomys* spp.), and birds. The importance of the various taxa in the diet, however, varied by season (Table 1). Voles were the most common prey in both seasons, but their importance was greater in the summer. The proportion of pellets that contained *Peromyscus* mice did not differ by season, but these mice made up a greater proportion of the total vertebrate prey items consumed during summer than winter. Harvest mice showed the greatest seasonal shift and were significantly more important in the owls' diet during winter. Kangaroo rats showed a similar pattern of increased importance during winter. The importance of birds in the diet did not differ by season.

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Table 1 Prey contents of Barn Owl pellets collected during summer (May–Sept 2007; $n = 143$) and winter (Jan–Feb 2008; $n = 163$) at Stillwater National Wildlife Refuge, Churchill County, Nevada

Prey and season	Total individuals ^a	Individuals per pellet ^b	Proportion of pellets ^c		Proportion of total vertebrate prey items ^d	
Voles (<i>Microtus</i> spp.)						
Summer	144	1.02 (1.06)	0.620	$P = 0.09$	0.372	$P = 0.06$
Winter	126	0.77 (0.94)	0.528		0.308	
White-footed mice (<i>Peromyscus</i> spp.)						
Summer	140	0.98 (1.59)	0.415	$P = 0.64$	0.362	$P = 0.001$
Winter	105	0.64 (1.00)	0.387		0.257	
Harvest mice (<i>Reithrodontomys</i> spp.)						
Summer	35	0.30 (0.62)	0.176	$P = 0.003$	0.090	$P < 0.001$
Winter	90	0.55 (0.99)	0.319		0.220	
Kangaroo rats (<i>Dipodomys</i> spp.)						
Summer	26	0.18 (0.45)	0.155	$P = 0.06$	0.067	$P = 0.006$
Winter	51	0.31 (0.64)	0.239		0.124	
Botta's pocket gopher (<i>Thomomys bottae</i>)						
Summer	10	0.07 (0.26)	0.070		0.026	
Winter	6	0.04 (0.19)	0.037		0.015	
Mountain cottontail (<i>Sylvilagus nuttalli</i>)						
Summer	4	0.03 (0.17)	0.028		0.010	
Winter	2	0.01 (0.11)	0.012		0.005	
Woodrats (<i>Neotoma</i> spp.)						
Summer	0	0.00	0.000		—	
Winter	3	0.02 (0.13)	0.018		0.005	
Muskrat (<i>Ondatra zibethicus</i>)						
Summer	3	0.02 (0.14)	0.021		0.008	
Winter	0	0.00	0.000		—	
Bats (<i>Myotis</i> spp.)						
Summer	0	0.00	0.000		—	
Winter	1	0.01 (0.08)	0.006		0.002	
Birds						
Summer	25	0.18 (0.40)	0.155	$P = 0.15$	0.065	$P = 0.84$
Winter	25	0.15 (0.54)	0.110		0.061	
Invertebrates						
Summer	12	0.08 (0.27)	0.081			
Winter	0	0.00	0.000			

^aMinimum total number of individuals identified in all pellets for each season and category of prey.

^bMean number of individuals per pellet on the basis of all pellets for the season (standard deviation).

^cProportion of all pellets for the season that contained the category of prey. Probability values are from G tests of independence comparing the proportions in winter and summer of the five principal categories of prey.

^dProbability values are from G tests of independence comparing the proportions in winter and summer of the five principal categories of prey, on the basis of 387 and 409 total vertebrate prey items detected during summer and winter, respectively.

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DISCUSSION

As most published studies elsewhere have found (Marti 1992), small mammals dominated the diet of the Barn Owl population we studied. Although the dominant prey species taken by Barn Owls vary by location (Marti 1992), the four main mammalian prey in our study, voles, *Peromyscus* mice, harvest mice, and kangaroo rats, have all been documented as common components of Barn Owl diet in at least some western habitats (Jones 1949, Smith et al. 1972, Marti 1973, 1988, Gubanyi et al. 1992, Van Vuren et al. 1998, Lockwood and Jones 2000). Some seasonal variation in diet was apparent, but it mainly took the form of a complementary shift in use of these same four prey; use of voles and *Peromyscus* mice declined during winter, while use of harvest mice and kangaroo rats increased. Whether these shifts in diet relate to seasonal changes in abundance of these species, and whether these shifts are typical of most years, is unknown.

At Stillwater, Barn Owls rarely took larger prey (adults >100 g). Pocket gophers (*Thomomys* spp.) have been documented as a major constituent of the Barn Owl's diet at some western sites, particularly during summer when small, dispersing young are available (e.g., Knight and Jackman 1984, Gubanyi et al. 1992, Van Vuren et al. 1998). The owls we studied may have taken gophers infrequently because they were rare in the region or, more likely, because other smaller prey items were more available and easily captured. Other studies have also documented cottontail rabbits (*Sylvilagus* spp.) and muskrats (*Ondatra zibethicus*) as rare but regular components of the Barn Owl's diet (e.g., Marti 1973, Franzeb and Laudenslayer 1982, Van Vuren et al. 1998). The size of adults of these species may limit the owls' using them as prey; on the basis of skull size, all cottontail and muskrat remains in our pellets were of juveniles.

Birds were taken regularly, representing just over 6% of all vertebrate prey items in both seasons. Birds have often been documented in the Barn Owl's diet, although most studies in the western United States have reported that they represent <5% of all prey items (Jones 1949, Marti 1973, 1988, Gubanyi et al. 1992, Van Vuren et al. 1998, Lockwood and Jones 2000). Otteni et al. (1972) suggested that Barn Owls may opportunistically increase their use of birds, particularly abundant colonially nesting or roosting birds, when the availability of rodents is low. Although we found no seasonal pattern in use of birds within our population, our study and another of the Barn Owl's diet at a site nearby in Nevada (Alcorn 1942) found most bird prey items to consist of colonial marsh birds, especially icterids.

Large invertebrates have occasionally been reported in the diet of some Barn Owl populations (Marti 1992). For example, in western North America, Jerusalem crickets (family Stenopelmaticidae) are eaten at many locations, and in some areas are regular prey (Smith and Hopkins 1937, Maser et al. 1980, Knight and Jackman 1984). To our knowledge, our study is the first to document the giant water bug as Barn Owl prey. These insects are apparently large enough (50–60 mm; Bland and Jaques 1978) to be worth pursuit when encountered. However, as in most Barn Owl populations, invertebrates likely represented a tiny proportion of the total biomass of prey taken.

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