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Bats as Predominant Food Items of Nesting Barred Owls

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Abstract - Between April and June 2016, we observed a pair of *Strix varia* (Barred Owl) rearing 2 chicks in a wooded, streamside city park in Valdosta, GA, and we observed 1 instance of an adult feeding a bat to a fledgling. Thirteen of 20 owl pellets collected from the area contained 37 *Myotis austroriparius* (Southeastern Myotis). This species of bat was the most frequent and abundant food item during the chick-rearing period, especially before fledging and for at least 17 days after. Birds partially replaced bats in the diet during the middle of this period. Owls commonly ate crayfish and June bugs and less commonly ate fish and a variety of small vertebrates throughout the period. To our knowledge, this is the first report of bats comprising a major dietary item for Barred Owls, including food given to the chicks.

Between 17 April and 19 June, 2016, we periodically observed a nesting pair of *Strix varia* Barton (Barred Owl) and their 2 chicks in Drexel Park—a wooded, streamside city park in Valdosta, GA. A few incidental observations later that summer indicated that both adult and juvenile birds left the natal area by late June or early July. The nest was a large, open-topped cavity ~7 m high in a *Magnolia virginiana* L. (Sweetbay) tree. On 13–14 May the still-downy owlets left the nest, although neither could fully fly for at least a week after leaving the nest. We observed the owlets over the next 3 days walking on the ground and climbing (with wing flapping) in trees and shrubs, and later perched higher in larger trees, near the parents. A pair of *Buteo lineatus* Gmelin (Red-shouldered Hawk) simultaneously raised a clutch of 3 nestlings (all 3 fledged in late May) in a stick nest about 16 m high in a *Pinus taeda* L. (Loblolly Pine) that was ~30 m from the owls' cavity tree. Close association and partitioning of prey resources between these 2 nesting raptors has been documented previously (Eckert 1987, Stewart 1949).

On 18 May, we observed 1 adult owl feeding a small brown bat to a fledgling. We collected 19 regurgitated pellets under the owls' roosting trees during the next month (19 May-19 June), and we added a pellet we found a month earlier to the sample. Thirteen of the 20 pellets contained from 1-7 bats each. Bats were identified to species primarily by dental formula; relative size of first 2 upper premolars (Menzel et al. 2002); and comparison of size and shape of skull, dentaries, and forelimb bones to skeletal specimens of several species of bats in the mammal collection of Valdosta State University. Number of bats per pellet represented the minimum whole number of bats that could account for paired structures such as dentaries (jaw bones) and usually matched the number of intact or mostly intact upper skulls. All 37 bats found in 13 pellets were Myotis austroriparius Rhoads (Southeastern Myotis; Table 1). In each of these pellets, the brown wooly fur of Southeastern Myotis constituted much of the volume. In 4 pellets, bats were the only apparent dietary item. Eleven of the 20 pellets included pieces of crayfish exoskeleton, and 12 pellets included 1 or more scarabaeid beetles (mostly, *Phyllophaga* sp. [May beetle or June bug]; Table 1). In the only pellet found in April or May that did not contain bat remains, we found a Blarina carolinensis Bachman (Southern Short-tailed Shrew). This pellet also contained scarabaeid beetles, a partial shell and vertebral column of a small turtle, and vertebrae and scales of a fish. Fish remains were found in 3 other pellets as well.

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Bats were more frequently missing from pellets collected in June (6 of 12 pellets) than those collected in April–May (1 of 8), and meals consisting of a single bat were found only in June pellets (4 of 12). In 3 of the June pellets (with 0 or 1 bat remains), the pellets included parts of a *Rattus rattus* L. (Black Rat). Bones consistent with 1 rat were divided among 3 pellets. Also, only in the June-collected pellets (6 of 12) did we find bird remains, including a *Cyanocitta cristata* L. (Blue Jay) and 2 *Cardinalis cardinalis* L. (Northern Cardinal) (Table 1).

We also observed on the ground under the trees where owls roosted a dead Southern Short-tailed Shrew (not eaten, but with a wound to the cervical area) and a female *Plestiodon laticeps* Schneider (Broad-headed Skink) with the head and shoulders eaten. Several feathers of a Blue Jay were found under a roost tree. Failure to find additional pellets may be because the owls were roosting directly over the creek on many days.

In our search of the literature on food habits, bats either were not eaten by Barred Owls or were a minor component of the diet. For example, stomachs examined from 136 Barred Owls in Maine sampled throughout the year found they relied mostly on small rodents and to a lesser degree squirrels, hares, beetles, and other insects (Mendall 1944). Bent (1961), who divided Barred Owl into Northern Barred Owl, Florida Barred Owl, and Texas Barred

Pellet		Number of remains								
no.	2016 date	$\operatorname{Bats}^{\operatorname{A}}$	$Crayfish \ pcs^{\scriptscriptstyle B}$	$Scarabaeids^{C}$	$Rattus^{D}$	Shrews ^E	Small turtles	Fish	Birds	
1	17-Apr	3	5	1	0	0	0	0	0	
2	19-May	7	22	1	0	0	0	0	0	
3	19-May	2	15	0	0	0	0	0	0	
4	19-May	4	0	1	0	0	0	0	0	
5	19-May	4	0	0	0	0	0	0	0	
6	19-May	2	0	0	0	0	0	0	0	
7	22-May	0	0	1	0	1	1	1	0	
8	22-May	4	0	0	0	0	0	0	0	
9	3-Jun	1	25	1	0	0	0	1	1 ^F	
10	3-Jun	0	20	2	0	0	0	0	<1	
11	3-Jun	0	0	1	0	0	0	0	<1	
12	3-Jun	0	0	1	0	0	0	1	1^{G}	
13	7-Jun	0	5	0	0	0	0	0	1^{G}	
14	7-Jun	1	0	0	<1	0	0	0	0	
15	7-Jun	0	25	0	0	0	0	0	<1	
16	10-Jun	1	30	1	<1	0	0	0	0	
17	13-Jun	1	33	1	0	0	0	1	0	
18	13-Jun	0	30	1	<1	0	0	0	0	
19	19-Jun	5	6	1	0	0	0	0	0	
20	19-Jun	2	0	0	0	0	0	0	0	

Table 1. Identified animal remains in 20 Barred Owl pellets from a nesting pair and 2 chicks in Valdosta, GA, in 2016.

^AAll bats were *M. austroriparius* (Southeastern Myotis), identified mainly by skull and jaw; number represents minimum whole number of bats to account for paired structures in pellets.

^BNumber of exoskeleton pieces, most ranging from 2 mm to 10 mm.

^CWhere they occurred, presumed to be parts of 1 entire beetle, or 2 if obviously different species.

^DPellets 14, 16, and 18 contained portions of the same rat

^EBlarina carolinensis (Bachman) (Southern Short-tailed Shrew)

^F*Cyanocitta cristata* (L.) (Blue Jay)

^G*Cardinalis cardinalis* (L.) (Northern Cardinal)

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Owl, listed bats (along with crayfishes and large beetles) among food items of Northern Barred Owls. Florida Barred Owls were said to "live on practically the same classes of food as their northern relatives ... Fiddler crabs and crayfishes form a considerable portion of their food at times" (Bent 1961:199). Bent (1961) mentioned, among other remains from 9 stomachs of Florida Barred Owls examined, a large beetle. Eckert (1987) noted that diet of Barred Owls is primarily rats and mice, although he listed other mammals including bats, many bird species, fish, reptiles, amphibians, and large insects including beetles. A Barred Owl was observed fishing in a river in central Florida (Smith et al. 1983).

Although we could not find any study concluding that bats formed a major part of the diet of Barred Owls, a congeneric owl in the British Isles, Strix aluco L. (Tawny Owl), was found to be the most important predator on native bats, with the species eating an estimated 169,000 bats per year (Speakman 1991). Bats were found to comprise $\sim 1\%$ of the diet of Strix occidentalis lucida Nelson (Mexican Spotted Owl), a sister species of the Barred Owl, in Arizona (Block et al. 2005). A pair of Bubo virginianus Gmelin (Great Horned Owl) roosting near a cave entrance in Oklahoma was found to have fed principally on Tadarida brasiliensis I. Geoffrey (Mexican Free-tailed Bats) for a period, with remains of 95 bats found in 28 pellets; 1 pellet contained remains of 8 bats (Chesser and Kennedy 1976). In a study of the native owls in Michigan, only 1 of the 1458 mammal and bird skulls identified from Asio otus L. (Long-eared Owl) pellets was a bat (Myotis lucifugus Le Conte [Little Brown Myotis]; Wilson 1938); similar samples from other species of owls in this study (including Barred Owl) included no bats. Similarly, a dietary study of 6 species of owls in Illinois found that only Long-eared Owl had bats in the diet, which included 2 bat species and composed <1% of the diet (Cahn and Kemp 1930). Additionally, Kaufman (1996) noted that Asio flammeus Pontoppidan (Short-eared Owl) and Megascops asio L. (Eastern Screech-Owl) sometimes eat bats. Little Brown Myotis has been noted in the diet of Great Horned Owls (Jung et al. 2011) and of Aegolius acadicus Gmelin (Northern Saw-whet Owl) in Canada. One of us (B.J. Bergstrom) has observed a Glaucidium brasilianum Gmelin (Ferruginous Pygmy-Owl) eating a Mexican Free-tailed Bat in King County, TX, at a daytime roost (March 1992) and 2-3 young Athene brama Temminck (Spotted Owl) catching small bats on the wing near dusk at a park in Delhi, India (May 2007).

Besides the Great Horned Owl study (Chesser and Kennedy 1976), to our knowledge, our observations herein on Barred Owl are the only other documented case of a specific North American owl including bats as a major dietary item, and the only documented case of a pair of owls feeding bats to their young and themselves during the parental care period. Also, to our knowledge, this is the first published report of Barred Owl predation on Southeastern Myotis; however, Rice (1957) deduced that an owl of undetermined species had captured and eaten at least 42 Southeastern Myotis at the entrance to a cave in Florida hosting a maternity colony. It is unlikely that such a large owl would be capable of catching so many small bats on the wing once the bats were airborne (and lacking evidence of the owls eating any of the other species of bat that forage in the area). Rather, owls may have found a monospecific roost of bats (perhaps in one of the many large tree cavities in the park) and captured these bats immediately upon emergence or while bats were torpid if the cavity were large enough for the owls to enter.

Barred Owls are known often to hunt diurnally (Bent 1961) and to cache their food (Elderkin 1987). Owls consuming such a large number of bats may be of some concern because bats have low reproductive potential and have recently experienced dramatic population declines due to white-nose syndrome (Frick et al. 2016) and mortality at wind turbines (Cryan et al. 2014). Populations of several species of *Myotis* have been severely

reduced by white-nosed syndrome, but Southeastern Myotis has not yet been affected (Frick et al. 2016). A pair of owls feeding young could eliminate or severely reduce, for example, a maternity colony of bats. One advantage of Southeastern Myotis over all other members of its genus in North America is that females produce 2 young per litter rather than 1 (Jones and Manning 1989).

It is also surprising that we found no evidence of these Barred Owls preying on *Sciurus carolinensis* L. (Gray Squirrel), which have been documented previously as food items (e.g., Mendall 1944), even though squirrels were common in the park and were active in the vicinity of the owls' roost trees.

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