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NESTING AND FOOD HABITS OF BARN OWLS IN SOUTH FLORIDA

PETER G. DAVID

South Florida Water Management District, Dupuis Reserve, 23500 SW Kanner Highway, Canal Point, Florida 33438

Abstract.—Barn Owl (*Tyto alba pratincola*) food and nesting habits were studied for four years at the Dupuis Reserve in south Florida. Barn Owls preyed almost exclusively on mammals, with the cotton rat (*Sigmodon hispidus*) accounting for 60% of the total prey biomass. Numbers of prey items declined over the study period, particularly the more wetland-dependent species, rice rat (*Oryzomys palustris*) and round-tailed muskrat (*Neofiber alleni*). This decline may have been due to the pre-existing overdrainage of the property accompanied by dry conditions in 1989 and 1990. The proportion of prey items in Barn Owl pellets varied significantly between months and years. Short-tailed shrew (*Blarina brevicauda*) and cotton rat were most important in the early and late nest stages, respectively. Nesting occurred in every month, except June, July, and August. Lower nest success coincided with less biomass consumption as reflected by pellets collected during the incubation and owlet development stages.

The reliability of using pellet analysis to determine food habits of Barn Owls (*Tyto alba*) has been well documented (Marti 1973, Smith et al. 1974, Colvin and McLean 1986). Because Barn Owls are cavity nesters and often return to nest at the same locations, large numbers of regurgitated pellets can be collected to provide important qualitative information regarding local small mammal populations. Analysis of owl pellets can also reveal the presence of resident species not otherwise known to occur (David 1988).

Barn Owls feed almost exclusively upon small mammals (Marti 1974, Herrera and Jaksic 1980, Marti 1992). In south Florida, there appears to be a dearth of information regarding Barn Owl nesting ecology and food habits. Chicardi et al. (1990) found that hispid cotton rats (*Sigmodon hispidus*) and short-tailed shrew (*Blarina brevicauda*) were the main prey items collected from Barn Owl pellets found in Orange County. Pellet analyses by Horner et al. (1974) and Miller (1994) at Paynes Prairie State Preserve in Alachua County, Florida, indicated

that round-tailed muskrat (*Neofiber alleni*) and marsh rice rat (*Oryzomys palustris*), respectively, were the most common food items. Trost and Hutchinson (1963) completed a more extensive analysis of food remains from a single nest site in Marion County and reported that cotton rats constituted over 75% of the total food items.

Barn Owl reproductive success in North America may depend heavily upon the abundance of voles *Microtus* spp. (Colvin 1986, Gubanyi et al. 1992). Colvin and McLean (1986) indicated that Barn Owls preyed almost exclusively upon *Microtus pennsylvanicus* from year to year. In contrast, Marti (1974) and Gubanyi et al. (l992) found significant differences in the annual proportion of Barn Owl prey.

This study is the first to document food habits of nesting Barn Owls in south Florida. Barn owl food habits, as determined by pellet analysis, relative to nesting status and success were studied over a four-year period.

Study Area and Methods

The study was conducted at Dupuis Reserve, in northwest Palm Beach County and southwest Martin County, approximately 30 km west of Jupiter, Florida. The study area comprised 8,746 ha of pine forest, improved pasture, freshwater marsh, and cypress forest.

Barn Owl pellets were collected approximately monthly between December 1987 and January 1992 (n=39 collections) from a loft in a wood barn located on the property. Pellets were soaked in a weak sodium hydroxide solution that dissolved the hair and isolated crania and lower mandibles for easier identification (Schueler 1972). Crania were identified using Golley (1962) and Stevenson (1976) and further verified by comparisons with collections at Archbold Biological Station, Lake Placid, Florida.

Biomass of prey species was determined using mean weights from Golley (1962), Horner et al. (1974), Lefebvre (1982), and collection specimens from Archbold Biological Station. Prey species weights were multiplied by the number of prey items and divided by the total for all species to calculate percent biomass. Percent occurrence was estimated by dividing the number of items collected for each species by the total number of items collected. Total biomass in grams recovered per day was calculated by dividing pellet biomass obtained since the previous collection by the number of days over the same time period. This recovery rate provided a standard measure to compare food consumption among the nesting periods and assumed that the number of pellets recovered within the barn accurately reflected owl prey consumption and consistent regurgitation rates.

At least two visits per month were made for each of the eight nest attempts observed to determine number of eggs, number of eggs hatched and number of young surviving to about 55 days—the approximate age Barn Owls fledged from the nest (Stevenson and Anderson 1994). The date of first egg laying was estimated by subtracting two days for each egg once nesting activity was detected.

SAS PROC FREQ chi-square contingency tables were used to test for independence in the proportion of round-tailed muskrat, cotton rat, rice rat, house mouse (*Mus musculus*), short-tailed shrew, least shrew (*Cryptotis parva*), and cotton mouse (*Peromyscus gossypinus*) in the barn owl diet. Contingency tables were used to determine whether the proportion of each prey species compared to the total of all other species differed significantly by month (12×2), by stage of the nesting cycle (5×2), between nesting and non-

nesting periods (2×2), and between years (4×2). A Bonferroni adjustment for multiple comparisons resulted in a significance level of 0.007 (0.05/7). Nest stages were divided into five categories based on nesting activity; 0=no nesting activity, 1=egg laying and incubation period, 2=hatched eggs with young up to 20 days, 3=young 20-40 days of age, and 4=young 40 days or having recently fledged. Categories 2 and 3 were selected to correspond to the most rapid growth period and the approximate age (40 days) when young owls reach their maximum weight (Marti 1992). Pellets collected in December 1987 and January 1992 were included in data analysis for the years 1988 and 1991, respectively. Nesting season data represent pellets collected while eggs or young were present.

RESULTS

A total of 1484 prey items of 12 vertebrate species was identified from Barn Owl pellets. A southeastern five-lined skink (*Eumeces inexpectatus*) was apparently killed but not consumed. Small mammals accounted for 99.6% of the Barn Owl food items and cotton rats comprised 60% of the prey biomass. Although round-tailed muskrat constituted only 5% of the prey items consumed, it represented the second most important prey item in terms of percent biomass (14%). Over half of the muskrat skulls were from juveniles as evidenced by the incomplete eruption of the molars.

Eight nest attempts were observed during the study (Table 1). Mean number of eggs laid per clutch was 5.0, while 23 (57%) hatched, and 18 owls survived to approximate fledgling age (i.e., 55 days). The lowest nest success at the site occurred during the nesting period beginning November, 1991, and during the two synchronous nesting attempts beginning in September, 1989 and January, 1990. These nesting periods corresponded to the lowest rates of food item recovery at 67, 147 and 157 gms/day, respectively.

The percentage of round-tailed muskrat, short-tailed shrew, and hispid cotton rats consumed by Barn Owls during the nesting season differed significantly with the stage of the nest ($p < 0.0001$, 4 d.f.). The proportion of short-tailed shrew consumed was highest during the

Table 1. Estimated start date, clutch size, brood size, and number of young surviving to fledgling age for Barn Owl nests observed at Dupuis Reserve.

Start Date	Clutch Size	Brood Size	# Fledged
January 1, 1988	5	4	4
November 10, 1988	6	6	5
September 16, 1989	5	1	1
September 22, 1989	4	3	1
January 21, 1990	4	2	1
January 22, 1990	4	0	0
October 18, 1990	4	4	3
November 1, 1991	8	3	3
Totals	40	23	18

early stages of nesting while the percentage of hispid cotton rats in the owl diet increased as nesting progressed to the approximate fledgling age of the young owls (Figure 1). Numbers of pellets and food items collected were generally higher during the latter stages of nesting and immediately following the nest period. Round-tailed muskrat was consumed more frequently during non-nesting periods and was the only species whose proportion in the diet was significantly different (χ^2=42.4, $p < 0.0001$, 1 d.f.) between the seasons (Figure 2). Fifty percent of the round-tailed muskrat skulls was collected during June, July, and August. The proportion of Barn Owl prey items varied significantly ($p < 0.0001$, 3 d.f.) among years as the number of prey items declined over the study period (Table 2). This decline was most evident in the proportion of round-tailed muskrat, house mouse, and rice rat in the Barn Owl diet. Diet varied significantly ($p < 0.0001$, 11 d.f.) by month for the proportions of all seven species. Mean numbers of prey items collected were highest between November and March when nesting owls were present.

Discussion

Because the Barn Owl is considered an opportunistic predator (Bunn et al. 1982), pellet analysis assumes that the number of food

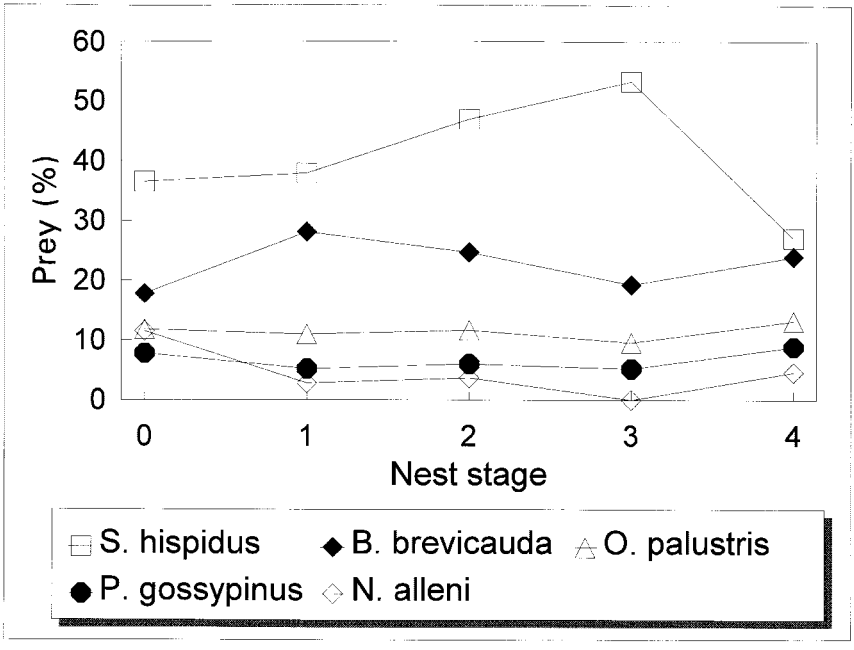

Figure 1. Proportion of prey items for five species relative to nest stage.

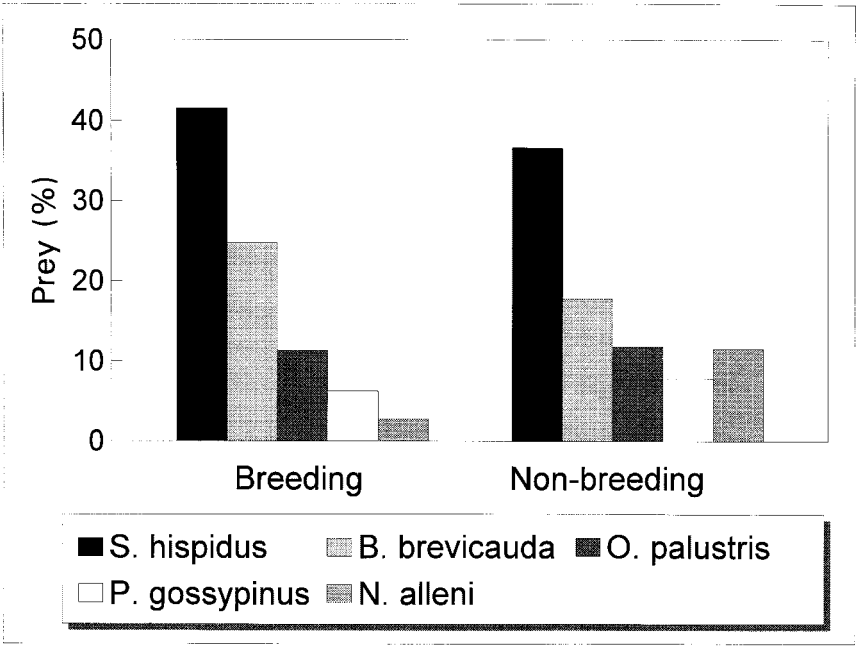

Figure 2. Percent prey composition of five species in breeding vs. non-breeding seasons.

items recovered in owl pellets is representative of overall food availability. Abundance of prey directly influences the reproductive success of Barn Owls (Otteni et al. 1972, Colvin 1986). Consequently, analysis

Table 2. Number of occurrences and (%) of prey by year recovered from Barn Owl pellets collected from Martin County, Florida.

Prey species	1988	1989	1990	1991	Totals
Cotton rat	130(27)	254(54)	112(38)	104(42)	600(40)
Short-tailed shrew	124(26)	74(16)	77(26)	69(28)	344(23)
Rice rat	81(17)	46(10)	22(7)	21(8)	170(11)
Cotton mouse	23(5)	42(9)	16(5)	17(7)	98(7)
Least shrew	25(5)	19(4)	25(9)	16(6)	85(6)
House mouse	40(8)	12(3)	18(6)	7(3)	77(5)
Round-tailed muskrat	36(7)	12(3)	16(5)	6(2)	70(5)
Rattus sp.	12(2)	3(<1)	1(<1)	3(1)	19(1)
Birds	2(<1)	1(<1)	3(1)	1(<1)	7(<1)
Eastern cottontail	1(<1)	0	1(<1)	0	2(<1)
Southern flying squirrel	0	1(<1)	1(<1)	0	2(<1)
Unidentified rodent	3(<1)	1(<1)	1(<1)	5(2)	10(<1)
Totals	477	465	293	249	1484

of prey choice during the breeding season may indicate which small mammals are most critical to reproductive success. At Dupuis, short-tailed shrew was consumed in higher proportions during the early nesting season. The proportion of cotton rats in the pellets increased during the latter stages of nesting as the demand for food and the ability of the young owls to consume larger prey would be greater.

Availability of certain prey may be influenced by climate. Colvin (1984) found a strong relationship between rainfall and *Microtus* sp. populations, that appeared to influence Barn Owl productivity. Round-tailed muskrat was an important owl food item in terms of percent biomass, but may be an unreliable prey item for nesting owls, because its reproduction and abundance may vary and be dependent upon water conditions or vegetative cover (Birkenholz 1963). During drought, muskrats will burrow into the substrate or abandon colonies completely (Tilmant 1975). Muskrats were nearly absent from pellet collections made at Dupuis between March and June, normally the driest period in South Florida. In contrast, large numbers of juvenile or subadult muskrats were recovered in the July and August pellet collections. This suggests that reproductive activity of this species may be stimulated once wetlands are inundated from wet season rainfall. The general decline in the percentage of rice rats and round-tailed muskrat recovered from Barn Owl pellets during this study may have been due to drier conditions in South Florida during 1989 and 1990.

Barn Owls relied almost exclusively on small mammals, particularly cotton rat. The high number of cotton rats in the diet would be expected due to its ecological similarity to *Microtus* spp. that are preyed upon in large numbers by Barn Owls in much of the eastern United States. Both of these small mammals prefer early successional habitat (Chicardi et al. 1990) and can be extremely abundant when this habitat is widely available (Golley 1962). Rice rat was not preyed upon in large numbers, despite being the closest weight and size equivalent to *Microtus* spp. One explanation for the low occurrence of this species is its predilection for wetlands (Baker 1991, Birkenholtz 1963), that have been extensively drained on the property since the 1950s. In contrast, the frequent occurrence in the pellets of cotton rats may indicate that they were able to colonize the readily available pasture. Because Barn Owls prefer open areas when hunting (Marti 1992), these pastures would represent the most accessible foraging areas on the property.

The mean number of eggs laid appeared to be consistent with other Florida nests (Stevenson and Anderson 1994) and the four eggs hatched per nest attempt was similar to findings outside of Florida by Reese (1972) and Bendel and Therres (1990). The 57% hatching rate in my study was comparable to that found by Otteni et al. (1972), Smith et al. (1974), and Bendel and Therres (1990). These studies and Guba-

nyi et al. (1992) reported higher fledgling rates than my study. Although they reportedly nest in every month of the year in the U.S. (Marti 1992), nesting Barn Owls were absent from the Dupuis barn during the hottest months of June, July, and August.

Barn Owls probably used several roost sites prior to nesting in the barn so that biomass consumption during this period may not be an accurate predictor of the number of eggs laid per nest. Because female Barn Owls begin incubation after the first egg is laid and generally stay at the nest while the adult male supplies food (Marti 1992), the lower nest success that occurred at the lowest rate of food item recovery suggests that a stronger relationship may exist between nest success and the food biomass recovered from the barn during the incubation and early nestling periods.

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