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FOOD OF BOBCATS AND COYOTES FROM CUMBERLAND ISLAND, CAMDEN COUNTY, GEORGIA

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ABSTRACT

Fifty scats of bobcats and 105 scats of coyotes from Cumberland Island, Camden County, Georgia, were examined during this study. Major foods of bobcats were mammals (81.8% volume), followed by birds (13.8%) and vegetation (4.2%), with only 0.2% invertebrates. Major foods of coyotes were plant materials (46.6% volume), mammals (43.8%), and invertebrates (6.0%). This is apparently the first report of coyote foods from Cumberland Island.

Key Words: Cumberland Island, Georgia; Coyote; Bobcat; Diet

INTRODUCTION

The bobcat, *Lynx rufus*, and the coyote, *Canis latrans*, are two of the medium sized carnivores presently occurring on Cumberland Island, Camden County, Georgia. The bobcat is native to Georgia and was likely found on Cumberland Island during presettlement times; however, it does not now occur on any of the other Georgia barrier islands. It apparently became extirpated on Cumberland Island around 1907 (1). Bobcats were reintroduced from Georgia and Florida, most from the lower coastal plain – 5 individuals in the 1970s and another 32 in 1988-1989, the latter by Diefenbach *et al*. (2, 3). Cumberland Island is the only Georgia barrier island that currently has bobcats. The population seems to be doing well, with tracks and sightings of adults and occasionally kittens.

Coyotes have moved eastward from more western states and have been in Georgia since the 1950s. They have been reported from most of the Georgia barrier islands, having first reached Cumberland in 1989 (Carol Ruckdeschel, personal observations; 4). A resident pair was confirmed in 2008 and they have remained since that time. The purpose of this paper is to compare the food habits of coyotes and bobcats on Cumberland Island.

Previous studies of southeastern bobcat food

Baker *et al*. (5) began bobcat food habits studies immediately after the 1988 introduction. Marsh rabbits (*Sylvilagus palustris*) were usually the most important prey, ranging from 33% to 61% of estimated prey biomass (6) and occurring in 33% to 64% of scats. Dietary diversity was negatively correlated with marsh rabbit abundance. White-tailed deer (*Odocoileus virginianus*) were important

prey ranging from 19% to 50% of estimated prey biomass in six survey periods. Cotton rats (*Sigmodon hispidus*) and gray squirrels (*Sciurus carolinensis*) were also very important foods. Raccoons (*Procyon lotor*), birds, cotton mice (*Peromyscus gossypinus*), and feral hogs also were occasionally eaten. Nelms (7, 8) performed follow-up studies a decade later, using the same methods. Marsh rabbits were again a major prey species, with feral hogs, cotton mice, gray squirrels, deer, and raccoons also commonly taken. Bobcats on Cumberland Island occasionally preyed on eggs of the American oystercatcher *Haematopus palliatus* (9). The decline in consumption of marsh rabbit and deer between the 1988-90 study of Baker *et al*. (5) and the 1997-98 study by Nelms (7), and the increase in consumption of other species, was significant in all seasons (8).

Bobcats in longleaf pine habitat in Baker County, Georgia (10) fed most frequently in all seasons on rodents, which occurred in 91% of 135 scats collected throughout the year. Cotton rats accounted for 70% of rodent prey and mice 20%. Birds were the second most common prey but occurred in only 14% of scats. Godbois *et al*. (10) were particularly interested in predation on northern bobwhite (*Colinus virginianus*), but that species made up only 10% of the bird remains in the scats. Other prey occurred in 12% of scats; these included nine-banded armadillo (*Dasypus novemcinctus*), opossum (*Didelphis virginiana*), snake, raccoon, striped skunk (*Mephitis mephitis*), and vegetation.

Wassmer *et al*. (11) examined 146 bobcat scats from the Archbold Biological Station in central Florida, collected throughout the year. Mammals, primarily eastern cottontails (*Sylvilagus floridanus*) and marsh rabbits, dominated the diet. Together with cotton rats, these major prey species were less important in summer than in other seasons, being replaced by a variety of small mammals. Deer were not found in these samples. Birds, mostly unidentified, were 10.1% of the prey items and only 1% of the biomass.

Maehr and Brady (12) studied the food of bobcats in Florida. The most important foods were cotton rats and rabbits. However, there was a significant decrease in cotton rats one year, and other prey types except rabbits increased.

Previous studies of southeastern coyote food

Thornton *et al*. (13) examined 86 coyote scats from south-central Florida, where coyotes have arrived relatively recently. The remains of ungulates, including white-tailed deer (of which at least 34% were fawns), domestic cow, and wild hog, were found in 50% of all scats and were common in all seasons. Rabbit remains (*Sylvilagus* spp.) occurred in 31.4% of the scats and rodents (mostly cotton rats) in 18.7%. The fruit of saw palmetto (*Serenoa repens*) was found in 23.3% of all scats, but only between June and November.

Stratman and Pelton (14) collected 166 coyote scats from Eglin Air Force Base in northwestern Florida and found plants were a remarkable 81% of the volume. Fruits of smilax accounted for 68% of scat volume in spring; blackberries and blueberries 83% in summer; saw palmetto and blueberries 40% in early fall, with persimmon (*Diospyros virginiana*) accounting for another 30%; and saw palmetto 64% in late fall. Whereas deer and hogs together supplied 25% of the volume of the rather small spring sample (n=8), vertebrates did not exceed

10% of the diet in any other season. Invertebrates, mostly beetles, accounted for 5, 11, 10, and 2% of the diet in the four seasons, respectively.

Lee and Kennedy (15) examined coyote stomachs from Tennessee, mostly from the western part of the state. Rodents were eaten by 39.2% of the 262 individuals, persimmons by 32.4%, rabbits by 28.8%, other vegetation by 26.1%, deer by 27.0%, and grass by 20.7%. The rodents most commonly eaten were cotton rats, deer mice (*Peromyscus* spp.), and voles (*Microtus* spp.). As most of these coyotes were taken in fall and winter, the deer remains found in their stomachs may have represented scavenging on wounded or field-dressed deer. Younger coyotes more often ate persimmons. Foods of lesser importance included livestock (16.7%), insects (12.6%), nongame birds (10.8%), game birds (4.5%), and, at very low frequencies, reptiles, amphibians, shrews, and opossums.

Foods in 64 coyote scats from the 5-county Albemarle Peninsula of eastern North Carolina (16), where red wolves (*Canis rufus*) were introduced, included small rodents (23.3% volume), rabbits (*Sylvilagus* sp., 28.4%), white-tailed deer (24.8% volume), other mammals (7.9% volume), vegetation (3.0%), and "other" (2.0%).

Schrecengost *et al*. (17) examined 415 coyote scats, collected over 15 months from the South Carolina coastal plain. Except in winter, >50% of food items were plants. In May, wild plums (*Prunus* spp.) were an important food; in June and July, blackberries; in July, black cherries (*Prunus serotina*); in August and November, pokeberry (*Phytolacca americana*); and in September-October, persimmon. Acorns and other nuts were important in late fall and winter. From December through April, animal foods dominated, including deer, wild hogs (presumably from carcasses discarded on the research station), cottontails, and small mammals. Grasshoppers and birds were eaten throughout the year but were an insignificant amount of the volume. Rabbits and small mammals were most important in winter and early spring, and only then approached the occurrence seen in other studies (*e.g.*, 13). Lagomorphs occurred in 31% of scats in February and small rodents in 23% of April scats. In no other month did either of these foods exceed 17% of scats.

To summarize, over the southeastern range, main foods of bobcats were generally rodents, especially cotton rats; rabbits; deer; feral hogs; and birds. Coyotes ate many mammals including deer, hogs, rabbits, and rodents, particularly cotton rats, but plant materials were also well represented (saw palmetto, smilax, blackberries, blueberries, persimmon, black cherry, and others). Invertebrates and birds were a minor component of the diet.

MATERIALS AND METHODS

Cumberland Island is the largest and southernmost barrier island off the coast of Georgia. Freshwater sloughs occur behind the barrier dune complex. They are extensive, but are shallow and often dry. The island is about 27 km long and averages about 2.4 km wide. There are temporary freshwater ponds that are recharged by precipitation. Major terrestrial habitats include maritime forest, beach and interdune, and flatwoods. Although there are numerous feral

horses and hogs (*Sus scrofa*), the northern part of the island is a National Seashore and designated as Wilderness. There are relatively few small vertebrates on the island, possibly because of the negative influence of the horses and pigs. Besides constant trampling and rooting, they consume acorns, Spanish moss, and herbaceous understory plants, all serving as food for small mammals, and secondarily for reptiles. The hogs also root decaying logs and stumps, and eat small vertebrates.

Feces of bobcats and coyotes were collected on Cumberland Island from 1985 to 2012, placed in plastic bags, and brought back to the laboratory for analysis. The feces were placed into large watch glasses and the materials sorted and identified. The percent volume of each item in each fecal sample was estimated by visual observation (18) to provide an estimate of the amount eaten. Percent frequencies (number of scats that contain a given food/total number examined) were calculated for the entire sample, but not by season. Some scats found were not fresh, and thus could not always be confidently assigned to a month. Volume data were examined in total and by season (winter: Dec.-Feb.; spring: March-May; summer: June-Aug.; fall: Sept.-Nov.). It should be noted that the scats were collected over a 27-year period. There were likely changes in the plant and prey populations over this period.

RESULTS

Bobcats (n = 50 scats)

Food of bobcats on Cumberland Island (Table I) was mostly mammals, 81.8% by volume. Birds were not specifically identified but made up 13.8% of the volume, vegetation 4.2%, and invertebrates only 0.2% of the volume.

Table I. Food of bobcats, *Lynx rufus*, from Cumberland Island, expressed in % volume (n = 50).

	% Volume	% Frequency
Mammals		
Sylvilagus palustris	25.1	42.0%
Sigmodus hispidus	17.8	40.0%
Sus scrofa	11.8	22.0%
Sciurus carolinensis	9.3	20.0%
Odocoileus virginianus	4.9	6.0%
Procyon lotor	3.8	8.0%
Peromyscus gossypinus	3.3	30.0%
Dasypus novemcinctus	2.7	6.0%
Oryzomys palustris	1.3	8.0%
Blarina carolinensis	0.1	2.0%

Table I (continued).

Unidentified rodent	0.1	6.0%
Unidentified mammal	1.6	6.0%
Subtotal	81.8	
Birds		
	13.8	42.0%
Vegetation		
Grass	0.9	26.0%
Misc. vegetation	3.3	62.0%
Ilex seeds	0.0	6.0%
Melamplus	0.0	2.0%
Subtotal	4.2	
Insect	0.2	8.0%
TOTAL	100.0	

Coyotes (n = 105 scats)

Mammals were the second most abundantly eaten food of coyotes on Cumberland Island (Table II). The coyote is thought of as a predator, but overall, the food most eaten on Cumberland Island was persimmon. It was mostly eaten in fall and summer, the seasons when it was available, although a little fruit remained on the plants and was eaten in winter. Other commonly eaten foods were hog, deer, saw palmetto, raccoon, and tough bully (*Sideroxylon tenax*). Reptiles were not commonly eaten, but they included a lizard, turtle, and two snakes.

Table II. Food of coyotes, *Canis latrans*, from Cumberland Island, expressed in % volume (n = 105).

	Seasonal % Volume				% Volume	% Frequency
	Spring (n=26)	Summer (n=23)	Fall (n=37)	Winter (n=19)		
Mammals						
Sus scrofa	36.5	28.1	4.7	7.8	18.3	29.1%
Odocoileus virginianus	14.0	2.2	6.9	37.4	13.1	17.5%
Procyon lotor	14.0	4.4	2.1	8.2	6.7	8.7%

Table II (continued).

Sylvilagus palustris	8.2	0.2	2.4	4.0	3.6	11.7%
Dasypus novemcinctus	0.0	3.5	0.4	0.0	0.9	3.9%
Sciurus carolinensis	1.7	0.0	0.0	0.0	0.4	2.9%
Oryzomys palustris	0.0	0.0	1.1	0.0	0.4	1.0%
Sigmodon hispidus	0.0	0.0	0.2	0.0	0.1	1.0%
Unidentified mammal	0.2	0.1	0.5	0.1	0.3	6.8%
Subtotal	74.6	38.5	18.3	57.5	43.8	
Birds, unidentified	9.5	0.0	0.1	4.7	3.2	12.6%
Reptiles	0.0	0.2	0.0	0.0	trace	4.0%
Fish, unidentified	0.0	0.3	0.1	0.0	0.1	2.9%
Invertebrates						
Coleoptera						
Scarabaeidae	0.7	2.2	1.1	0.1	1.0	22.3%
Carabidae	0.3	0.0	0.6	0.4	0.4	8.7%
Curculionidae	0.1	0.0	trace	0.2	0.1	4.8%
Calosoma sp.	0.4	0.0	0.0	trace	0.1	2.9%
Misc. Coleoptera	0.1	1.0	0.2	0.1	0.3	10.5%
Orthoptera						
Gryllidae	5.0	0.6	2.2	0.4	2.2	27.2%
Acrididae	0.7	0.3	0.3	0.1	0.4	12.6%
Blattidae	0.0	0.1	0.0	0.0	trace	1.9%
Lepidoptera: larvae	0.2	0.5	1.1	0.1	0.5	9.7%
Odonata: Anisoptera & Zygoptera	0.1	0.0	trace	trace	trace	2.9%
Diptera: Tipulidae	trace	0.0	0.1	0.0	trace	1.9%
Hemiptera (mostly Pentatomidae)	trace	0.0	0.0	0.1	trace	2.9%
Hymenoptera						
Formicidae	trace	0.6	0.0	0.0	0.1	
Misc. Hymenoptera	0.0	trace	trace	0.0	trace	

Table II (continued).

Unidentified Insect	trace	0.0	0.1	0.0	trace	
Ixodidae	trace	0.0	0.0	trace	trace	
Crab	0.2	0.8	0.4	0.0	0.4	
Diplopoda	0.0	0.0	0.2	0.0	0.1	
Ocypode	0.0	0.0	0.8	trace	0.3	
Subtotal	7.8	6.1	7.1	1.5	6.0	
Plant Materials						
Diospyros virginiana	0.0	25.1	43.1	0.1	20.7	
Serenoa repens	0.0	1.7	16.0	6.3	7.3	
Sideroxyon tenax	0.0	0.9	12.2	12.5	6.7	
Misc. vegetation	4.5	11.1	2.7	10.0	5.9	
Vitaceae	trace	12.7	0.1	0.0	2.8	
Grass	1.0	1.2	0.4	2.5	1.1	
Sabal palmetto	0.0	0.0	0.0	5.2	0.9	
Vaccinium sp.	0.0	2.8	0.0	0.0	0.6	
Ilex sp.	2.5	0.0	0.0	0.0	0.6	
Subtotal	8.0	55.5	74.5	36.6	46.6	
TOTAL	99.9	100.1	100.1	99.7	99.9	

DISCUSSION

Major foods of bobcats and coyotes on Cumberland Island are compared in Table III. Mammals and birds made up the majority of the food of bobcats, whereas plant material and mammals made up the majority for coyotes. The three top species of mammals eaten by coyotes – feral hog, whitetail deer, and raccoon -- were all taken less by bobcats. Three plant species were important for coyotes, whereas bobcats probably took vegetation incidentally. Likewise, a variety of invertebrates were included in the coyote diet, whereas invertebrates made up only a small amount of the food of bobcats.

Table III. Comparison of major foods of bobcats and coyotes on Cumberland Island.

	Bobcats	**Coyotes**
Mammals	(81.8)	(43.8)
Sylvilagus palustris	25.1	3.6
Sigmodus hispidus	17.8	0.1
Sus scrofa	11.8	18.3
Sciurus carolinensis	9.3	0.4
Odocoileus virginianus	4.9	13.1
Procyon lotor	3.8	6.7
Peromyscus gossypinus	3.3	0.0
Dasypus novemcinctus	2.7	0.9
Birds	(13.8)	(3.2)
Plant Materials	(4.2)	(46.6)
Diospyros virginiana		20.7
Serenoa repens		7.3
Sideroxylon tenax		6.7
Invertebrates	(0.2)	(6.0)

Rabbits and cotton rats were the most commonly taken foods of bobcats, but were seldom eaten by coyotes. Hogs ranked third for bobcats, first for coyotes; and deer were third most important for coyotes, but fifth for bobcats.

Rabbits are a common prey of bobcats, and were the most often taken on Cumberland. Before the occurrence of bobcats, marsh rabbits were much more abundant, but soon decreased (as observed by decreasing rabbit signs by Carol Ruckdeschel), and are now uncommon. Baker *et al*. (5) acknowledged that more study would be required to document long-term trends in marsh rabbits, or to attribute the decline to the introduction of bobcats. Island rabbits were naïve when bobcats were introduced, not having been exposed to a cruising predator, so they were easily caught at first. By the time the coyotes arrived, the rabbits had most likely learned to be wary or wary rabbits were selected. Thus, bobcats, immediately after their introduction, had a great impact on marsh rabbits whereas coyotes had much less impact due to their later arrival.

The second most common food of bobcats, the cotton rat, was seldom eaten by coyotes. This seemed surprising as cotton rats are often eaten by coyotes elsewhere (13, 15, 19, 20, 21, 22, 23, 24). Cotton rat populations are cyclic on the island, for which the specific driving factors have not been identified, but it seems clear that the coyote, at present, has little effect on that species.

Birds were the third most abundant prey by volume in bobcats, but were seldom eaten by coyotes. This difference reflects different hunting behaviors of the predators. Bobcats tend to stalk their prey, whereas coyotes move between clumps of vegetation thus often flushing potential bird prey.

Four public deer/hog hunts a year are held on Cumberland Island from October through January, and feral hogs are shot on the island year round, the carcasses being left in the field for scavenging. Most of the hogs eaten are probably these. These hunts may obscure natural carnivore food preferences in this study, as well as studies elsewhere. Hogs were the most common mammalian food of the coyote on Cumberland Island, but only ranked third for bobcats.

There were major seasonal differences in foods eaten by coyotes. Seasonal data are not presented for bobcats, as the samples were so small and over so many years. Diefenbach *et al*. (8) observed that deer were a primary prey of bobcats following their introduction. Deer then declined in abundance, and oak regenerated at a faster rate, suggesting a trophic cascade effect of bobcat reintroduction to the island. Deer populations and the mast crop cycle naturally, with the deer population increasing in years after good mast crops. Also, rabbits and deer were naïve when bobcats were introduced, which certainly influenced their availability. Coyotes ate hogs in all seasons, but mostly spring and summer. This suggests that coyotes may have killed hogs as well as finding them dead, whereas both species scavenge. Bobcats are able to capture piglets, and Carol Ruckdeschel has found freshly killed ones on Cumberland.

Immediately following the introduction of bobcats to the island, their main foods were marsh rabbits, deer, cotton rats, and gray squirrels, followed by raccoons, birds, cotton mice, and feral hog (5). Thus they were fairly similar to those occurring in the present study, but likely reflect prey naïveté at the time. Birds were more important in our study than in the study of Baker *et al*. (5). Nelms (7, 8), a decade later, again found marsh rabbits were important. However, other items were taken more in certain seasons: hogs, cotton mice, gray squirrels, deer, and raccoons. Thus, the results from the two studies were similar to ours but there was difference in the amounts of the various foods, especially seasonally. Our data are also similar to those of Godbois *et al*. (10) from Baker County in southwestern Georgia.

To summarize, the major foods of bobcats were vertebrates (rabbits, cotton rats, birds, and hogs), whereas those of coyotes were divided between vertebrates (hogs, deer, and raccoons) and fruit. The foods of these two predators are quite different, which should limit competition between them.

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