

## COYOTE FOODS IN THE BLACK HILLS, SOUTH DAKOTA

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Coyotes (*Canis latrans*) are one of the most widely studied animals in North America. The primary reason that much effort has been directed toward understanding the coyote is its feeding patterns. Coyotes prey upon domestic animals (Murie 1951, Gipson 1974, MacCracken 1982) and game animals (Fichter et al. 1955, Beasom 1974, Salwasser 1974, MacCracken and Hansen 1982), and feed on fruit and vegetable crops (MacCracken 1982). Presumably, the primary objective of most coyote research is to gain knowledge of coyote ecology which can be used to decrease conflicts with man.

Generalizations concerning coyote feeding patterns become apparent when the literature is examined. Where leporids are abundant they dominate the coyote diet (Sperry 1941, Clark 1972, MacCarcken 1981). Authors who conducted studies in areas known to have low populations of leporids reported that rodents, deer (*Odocoileus* spp.), livestock, or vegetation made up the bulk of coyote diets (Murie 1935, Fichter et al. 1955, Hilton 1978, Ribic 1978). Coyotes have been described as opportunistic predators for decades (Bond 1939, Todd and Keith 1983). However, no studies have been published in which the objective was to determine if coyotes are opportunistic predators.

Even though studies of coyote food habits are numerous in the literature, the foods of coyotes have not been determined for many ecosystems that they in-

habit. Lehner (1976) suggested that knowledge of coyote feeding strategies may allow man to alter the role that livestock and, presumably, game animals play in those strategies. Without localized information on coyote food habits little can be accomplished toward altering the role of some animals in the coyote diet. The Black Hills of South Dakota and Wyoming are without published information on coyote food habits.

The purpose of this paper is to report the results of a study that examined coyote food habits in the Black Hills of South Dakota.

### STUDY AREA AND METHODS

The Black Hills encompass approximately 4,640 km<sup>2</sup> of southwestern South Dakota and northeastern Wyoming. The vegetation is dominated by ponderosa pine (*Pinus ponderosa*) plant communities (Thilenius 1972). Fire suppression and decreased logging have resulted in large portions of the Black Hills being covered with pole (<20 cm dbh) stands of pine with little understory production. These areas support few of the mammals that are the usual prey of coyotes. Three broad regions of the Black Hills have been described by Thilenius (1972). The central granite region is dissected with numerous draws and canyons with elevations ranging from 1,300 to 1,800 m. The central area is surrounded by a limestone plateau at approximately 2,000 m. The peripheral region is composed of hogback ridges separated from the main body of the Black Hills by the Red Valley at about 1,300 m (Thilenius 1972).

Coyote feces were collected at 1-2-month intervals during summer 1981-82 from areas in the Black Hills representative of the three geographic regions pre-

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Table 1. Percent relative dry matter ingested (g) of foods of coyotes in the Black Hills, South Dakota, 1981-82. Estimates were obtained by quantification of prey remains in coyote feces and are broken down by season. Numbers in parentheses indicate the number of feces examined.

Food item <sup>a</sup>	Season				Overall
	Winter (53)	Spring (50)	Summer (50)	Autumn (55)	
<b>Mammals</b>					
<i>Odocoileus virginianus</i>	71.6	39.7	48.5	37.8	43.5
<i>Sylvilagus nuttalli</i>	10.5	18.4	13.1	14.6	16.3
<i>Microtus</i> spp.	5.8	4.6	20.2	10.8	12.2
<i>Tamiasciurus hudsonicus</i>	2.7	10.7		5.1	5.1
<i>Lepus townsendii</i>		9.7		5.1	4.3
<i>Cervus elaphus</i>	3.8			5.3	3.5
<i>Odocoileus hemionus</i>				3.5	1.8
<i>Bos taurus</i>				3.5	1.8
<i>Erethizon dorsatum</i>	3.7			1.7	1.7
<i>Equus caballus</i>		5.0			0.9
<i>Antilocapra americana</i>				1.8	0.9
<i>Thomomys talpoides</i>			12.8		0.9
<i>Peromyscus maniculatus</i>				1.1	0.6
<i>Neotoma cinerea</i>		7.1			0.6
<b>Birds</b>					
<i>Meleagris gallopavo</i>		1.8		2.6	2.0
Unidentified		0.1		1.7	1.0
Passeriformes			1.9	1.0	0.5
<i>Colaptes cafer</i>				0.8	0.1
<b>Insects</b>					
Orthoptera				0.9	0.5
Coleoptera	0.2	0.1	0.3	0.3	0.2
Diptera larvae		0.2			0.1
<b>Vegetation</b>					
Plant fragments	0.4	0.3	1.7	1.7	0.6
Gramineae		0.4	0.3	0.4	0.3
<i>Prunus americana</i>			0.3	0.6	0.2
<i>P. virginiana</i>			0.2	0.2	0.1
<i>Pinus ponderosa</i> seed	0.1	0.1		0.2	0.1
<i>Rubus pubescens</i>				0.2	0.1
<i>Malva rotundifolia</i>		0.1		0.2	0.1

<sup>a</sup> Other items recovered from coyote feces in trace amounts (<0.1%) and nonfood items were *Pinus ponderosa* needles and cones, Hymenoptera, unidentified insect, *Bromus tectorum* seed, *Triticum aestivum* seed, bone, ungulate hoof, sand, rock, wood, charcoal, and string.

viously described. Only intact, relatively fresh feces were collected and all were aged to season based on collection date for fresh defecations or general appearance for older scats.

Scats were oven-dried for 48 hours at 60 C and weighed. Dried scats were placed into fine mesh nylon bags and soaked in tap water for 24 hours. The bags containing scats were then washed without soap in a commercial clothes washer until all

soluble material was removed. The bags were then tumbled dry in a clothes drier (MacCracken 1980). Bag contents were emptied into a plastic tray and remains of food items identified to species, when possible, by comparison with reference materials and hair characteristics (MacCracken 1980).

Food items were quantified based on frequency of occurrence which was then converted to grams of dry matter ingested

following procedures outlined by Johnson and Hansen (1979). Johnson (1981) validated the accuracy of the technique.

Data on coyote foods were pooled across areas and broken down by season on a calendar basis. Kruskal-Wallis nonparametric one-way ANOVA was used to determine if coyote foods varied significantly ( $P < 0.05$ ) with season.

## RESULTS

There were no differences ( $P > 0.05$ ) among seasons in coyote food habits. Overall, mammals made up approximately 93% of the diet, birds 4%, insects 1%, and vegetation 2% (Table 1). White-tailed deer (*Odocoileus virginianus*), Nuttall's cottontails (*Sylvilagus nuttalli*), and voles (*Microtus* spp.) were the mammals most often found in the scats examined. Wild turkeys (*Meleagris gallopavo*) were the most abundant bird remains found in the scats. Insect parts were primarily from grasshoppers (Orthoptera), and vegetation was mostly small plant fragments from the stomachs of prey and large pieces of grass (Table 1).

Although seasonal diets were not different ( $P > 0.05$ ), some foods appeared in scats more often, or exclusively, in one season. White-tailed deer were most abundant in winter scats, voles in summer and fall scats. Red squirrels (*Tamiasciurus hudsonicus*) and wild turkeys were found most often in spring samples. Grasshoppers were most abundant in fall scats as were the fruits of dwarf red raspberry (*Rubus pubescens*) and American plum (*Prunus americana*). The number of different food items in a seasonal diet was greatest for fall and least for winter.

## DISCUSSION

White-tailed deer were the major food of coyotes in the Black Hills during all seasons. Deer populations have declined

over the past 10 years in the Hills, which is probably due to a combination of factors, perhaps including coyote predation. In the eastern United States white-tailed deer are often the major prey of coyotes (Hilton 1978), especially during winter in the form of carrion (Berg and Chesness 1978). Differentiating among carrion, adult, and fawn deer remains in scats is probably not reliable (MacCracken 1981).

Recent research on coyote social organization in relation to prey size and availability has shown that coyotes form packs to hunt cooperatively or defend carcasses when deer (Bowen 1981) or wapiti (*Cervus elaphus*) (Bekoff and Wells 1980) are the primary winter prey. In both studies packs disbanded during spring and summer when rodents and/or leporids became the major food of coyotes. A similar situation could exist in the Black Hills. In these areas, during winter, coyotes are filling a niche that has been relatively recently vacated due to the extirpation of the gray wolf (*Canis lupus*).

The differential seasonal consumption of some foods by coyotes in the Black Hills is in agreement with the commonly expressed view that coyotes are opportunistic feeders. Foods consumed in this manner (turkeys, fruit, grasshoppers) correspond to the time of year when they are most available. However, these foods never make up a major portion of the coyote diet (Table 1). We believe that the use of the term opportunistic to describe coyote feeding patterns is an oversimplification of an animal with complex behavior patterns. Perhaps such thinking has resulted in our inability to effectively manage coyotes beyond attempts at total extermination.

Experiments designed to test the assumptions and predictions of optimal foraging theory have greatly increased our understanding of the mechanisms by

which predators forage (Pyke et al. 1977, Rudolph 1982). One of the basic implications of optimal foraging theory is that predators react to the consequences of pursuing a certain food type. If we are to fully understand coyote feeding strategies and decrease coyote-human conflicts, controlled experimental studies must be conducted.

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