FOOD HABITS OF COYOTES INHABITING THE BLACK HILLS AND SURROUNDING PRAIRIES IN WESTERN SOUTH DAKOTA

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ABSTRACT

We examined the relationship between coyote (Canis latrans) food habits and relative density indices (RD) in the Black Hills and surrounding prairies (westcentral and northwest) of western South Dakota. Relative density indices (RD = # scats/km/day) were estimated, and 150 scats were collected along 57 fecal line transects from February – October 1998. Overall mean relative density indices were 57.9 in the Black Hills, 43.6 in the westcentral prairie, and 10.4 in the northwest prairie. Correction factors were used to associate relative frequencies of prey remains in feces to actual amount of prey consumed. In the Black Hills and prairie regions, mammals occurred most frequently, as measured by percent-of-scats, followed by vegetation, invertebrates, and birds. Mammals also comprised the greatest portion of coyote diets, as determined by fresh-weight-of-prey. Within the mammalian category, small mammals occurred most frequently, but white-tailed deer (Odocoileus virginianus) comprised the largest portion of diet by fresh weight in the Black Hills. This may be due to higher relative density indices of coyotes and increased vulnerability of a declining deer population in the Black Hills as compared to the surrounding prairie region. Conversely, small and medium-sized mammals occurred most frequently and comprised the largest portion of diet by fresh weight in the prairie region. An opportunistic predator such as the coyote may have adjusted its feeding strategy to meet local conditions in the Black Hills and prairie regions of South Dakota.

Keywords

Canis latrans, correction factors, coyote, diets, food habits, western South Dakota

INTRODUCTION

Coyotes are one of the most important and abundant predators in the prairie region of the central United States (Brillhart and Kaufman 1994). As a
The role of the coyote in the biological community holds great interest, particularly with respect to management issues of control and conservation (Caughley and Sinclair 1994). Tremendous effort has been directed toward understanding the effect of coyote predation on big game and domestic livestock (MacCracken and Uresk 1984). Understanding food habits and predator-prey dynamics is fundamental for determining the role of carnivores in ecosystems (Korschgen 1980). Numerous factors in the predator-prey relationship, e.g., abundance and availability of prey, play important roles in species ecology and may influence population dynamics of predators (Windberg 1995). Effects of predators on their prey populations are determined by their numerical and functional responses to prey densities (Solomon 1949).

Information gained from food habit studies can be used by wildlife managers to better understand preferred foods, to assess wildlife damage to crop and livestock, and to assess the role of nutrition in population dynamics. Coyotes are often associated with predation on domestic livestock (Connolly et al. 1976, Shivik et al. 1996), poultry, waterfowl (Sargeant et al. 1993, Sovada et al. 1995), and other wildlife species (Clark 1972). Furthermore, increased concern toward predators by ranchers and wildlife managers coincides with increasing predator densities.

As opportunistic predators, coyotes have the ability to change their diet both spatially and seasonally in response to changing prey availability (Clark 1972, Todd and Keith 1983, Parker 1986). Coyote food habits have been examined in many areas including the Black Hills (MacCracken and Uresk 1984), southwest North Dakota (Lewis et al. 1994), and Nebraska (Huebschman et al. 1997). However, food habit and predator density studies are limited in the prairie region of western South Dakota. The purpose of this study was to determine food habits of coyotes in the Black Hills and prairie regions of western South Dakota by incorporating correction factors from coyote feeding trials conducted by Kelly (1991). Furthermore, we wanted to examine the relationship between relative density indices and food habits of coyotes in the Black Hills and prairie regions of South Dakota.

STUDY AREA

Our study was conducted within two regions (i.e., Black Hills and prairie) of western South Dakota. The Black Hills region of South Dakota was comprised of portions of Lawrence, western Pennington, and Custer counties. The prairie region consisted of a westcentral study area represented by Haakon and north Jackson counties and a northwest study area located in Harding County (Fig. 1). The Black Hills region is an isolated mountainous area in western South Dakota and northeastern Wyoming. Elevations in the Black Hills range from 973 to 2,202 m (Turner 1974). The Black Hills have both semi-arid continental and mountain climate types. Dominant overstory vegetation in the Black Hills consists of ponderosa pine (*Pinus ponderosa*) and white spruce (*Picea glauca*) interspersed with small stands of aspen (*Populus tremuloides*) and paper birch (*Betula papyrifera*) (Thilenius 1972). Primary understory vegetation
consists of snowberry (Symphoricarpos albus), spiraea (Spiraea betulifolia), serviceberry (Amelanchier alnifolia), bearberry (Arctostaphylos uva-ursi), and juniper (Juniperus communis). Forests are managed by the USDA Black Hills National Forest primarily for timber production and livestock grazing. Common wildlife species in the Black Hills are deer (Odocoileus spp.), pronghorn (Antilocapra americana), elk (Cervus elaphus), wild turkey (Meleagris gallopavo), bighorn sheep (Ovis canadensis), mountain lions (Felis concolor), and golden eagles (Aquila chrysaetos).

Approximately 80% of the land in the westcentral and northwest prairie region is rangeland with the remaining land being cultivated crops, tame pasture, and hay (Faulkner 1997, Johnson 1988, Schlepp 1987). Common vegetation in the westcentral and northwest prairie regions includes western wheatgrass (Agropyron smithii), green needlegrass (Stipa viridula), blue grama (Bouteloua gracilis), and prairie Junegrass (Koeleria pyramidata). Dominant shrubs in the northwest prairie area include silver sagebrush (Artemisia cana) and big sagebrush (A. tridentata). Common wildlife species on the prairies are deer, pronghorn, grouse (Tympanuchus phasianellus), jackrabbit (Lepus townsendii), red fox (Vulpes vulpes), badger (Taxidea taxus), and prairie dogs (Cynomus ludovicianus).

METHODS

Coyote fecal samples were collected from 57 established fecal line transects located in western South Dakota (Gerads 2000) from February – October 1998. Samples from the westcentral and northwest prairies were analyzed together.
and separately. Collected coyote fecal samples were stored in a –80°C freezer for 24 hours and then oven dried at 60°C for 24 hours to kill eggs of Echinococcus spp. (Colli and Williams 1972). Each sample, along with an identification label, was secured in a ripstop nylon bag (18- x 18-cm), soaked in hot water for ≥ 48 hours (Johnson and Hansen 1979), and squeezed and kneaded to breakdown the fecal matrix (Springer and Smith 1981). A group of 50-bagged samples was washed in an automatic clothes washer and then dried in a clothes dryer (Johnson and Hansen 1979).

Food items were hand-separated into holding containers and each diagnostic part (e.g., hair and teeth) was counted by species. An electronic balance was used to weigh the amount of bone, hair, and other diagnostic parts by species (Kelly 1991). A roller press was used to obtain cuticular impressions of guard hairs on acetate strips (Bowyer and Curry 1993) and reference collections and other materials were used to identify food items (Adorjan and Kolenosky 1969, Jones and Manning 1992, Moore et al. 1974). Food items were separated into categories based on prey size and type (Huebschman et al. 1997). The mammal category was separated into five subcategories: 1) small-sized mammals, e.g., mice (Peromyscus spp.) and voles (Microtus spp.), 2) lagomorphs, 3) medium-sized mammals, e.g., raccoon (Procyon lotor), prairie dog, and pocket gopher (Thomomys talpoides), 4) deer/pronghorn, and 5) livestock, e.g., domestic cattle and bison (Bison bison). Other categories included birds, vegetation, invertebrates, and unknown.

Food habits were quantified by percent-of-scat (POS) and by percent-fresh-weight-of-prey (PFWP). Percent-of-scat (or frequency of occurrence) is the percent of a sample of fecal piles in which a prey species occurred (Kelly 1991) and describes how common an item is in a diet. Percent-of-scat was calculated using the formula: (# times prey species occurs / # fecal piles examined) x 100. Percent-fresh-weight-of-prey is measured by using 1) a correction for the amount of a prey item represented by its remains in a fecal sample, 2) how frequently a prey item occurred in a sample of fecal piles, and 3) the amount of a fecal pile attributable to each prey item (Kelly 1991). We used the tooth-detection model and visual estimates to apportion fecal pile contents and the kg-per-scat estimators (Kelly 1991). Because POS does not equate to percent of diet and detection rates of prey items in scats may vary with prey and/or meal size, correction factors from coyote feeding trials (Kelly 1991) were used to associate relative frequencies of prey remains in fecal piles to the actual amount of prey consumed using Program Scat 1.5 (Kelly and Garton 1993). Values based on PFWP correction factors are additive, not overlapping like POS values. Moreover, no correction factors are currently available for food items composed of vegetation or large food items such as bison and cattle. These large prey species exceeded the largest prey size allowable by the coyote regression model.

Relative densities of coyotes in western South Dakota were estimated using fecal line surveys (Gerads 2000). Overall mean relative density indices for coyotes were 57.9 in the Black Hills, 43.6 in the westcentral prairie, and 10.4 in the northwest prairie (Gerads 2000). Food habits and relative density indices of coyotes were qualitatively compared within and across study areas located.
in western South Dakota. Relative density (RD) of predators was determined using the formula: $\text{RD} = \left( \frac{\# \text{ fecal piles}}{1.61 \text{ km}} \times \frac{\# \text{ days between collection periods}}{1000} \right)$ (Gerads 2000).

RESULTS

A total of 100 fecal samples was analyzed from the Black Hills and 50 fecal samples from the prairie region; all samples were collected in 1998. Seasonal trends could not be evaluated for coyote diets due to the small number of samples analyzed in each month. Relative density indices were calculated for coyotes in the Black Hills and westcentral and northwest prairie regions for 1998.

Black Hills

Mammalian prey remains occurred most frequently (99.0 POS) in coyote diets in the Black Hills region in 1998, followed by vegetation (79.0 POS), invertebrates (32.0 POS), and birds (8.0 POS) (Table 1). Small-sized mammals, deer/pronghorn, and medium-sized mammals were among the most common categories of mammalian prey (76.0, 55.0, 25.0 POS, respectively). Most common small mammal species included voles (Microtus spp.) and mice (Peromyscus spp.), and medium-sized mammals included raccoon, prairie dogs, porcupine (Erethizon dorsatum), and northern pocket gopher. Less common species occurring in the fecal samples included birds (8.0 POS), lagomorphs (6.0 POS), and livestock, i.e., bison and cattle, (2.0 POS). Vegetation included wild plum (Prunus americana) and buffaloberry (Shepherdia spp.) and invertebrates consisted mainly of grasshoppers (Order Orthoptera).

According to PFWP calculations, mammals comprised the greatest part of the diet of coyotes in the Black Hills region (99.2 PFWP), followed by invertebrates (0.8 PFWP), and birds (<0.1 PFWP) (Table 1). Deer comprised the largest part of coyote diets within the mammalian category (64.4 PFWP), followed by small and medium-sized mammals (25.3 and 8.6 PFWP, respectively), and lagomorphs (0.9 PFWP). Although, livestock were a part of the diet, no correction factors were available to estimate PFWP.

Prairie region (westcentral and northwest)

Mammalian prey remains occurred most frequently (92.0 POS) in coyote diets in study areas located in the prairie region of western South Dakota in 1998, followed by vegetation (62.0 POS), invertebrates (28.0 POS), and birds (22.0 POS) (Table 1). Small-sized mammals occurred most frequently in the mammalian category (66.0 POS), followed by medium-sized mammals (38.0 POS), livestock (24.0 POS), lagomorphs (10.0 POS), and deer/pronghorn (4.0 POS). Voles, mice (Peromyscus spp., Onychomys leucogaster, Zapus hudsonius, and Reithrodontomys spp.), pocket gophers, and prairie dogs were the most common mammalian prey items. Livestock consisted mainly of cattle and
domestic sheep. Less common species included porcupine, raccoon, badger, and lagomorphs. Vegetation consumed included wild plum and grasses. Invertebrates consisted mainly of grasshoppers.

In 1998, PFWP of major categories for prey items of coyotes in the prairie region was 86.2 PFWP for mammals, followed by birds (11.3 PFWP), and invertebrates (2.5 PFWP) (Table 1). Small and medium-sized mammals (34.6 and 34.0 PFWP, respectively) comprised a large part of coyote diets within the mammalian category, followed by deer/pronghorn (9.2 PFWP), and lagomorphs (8.4 PFWP). Although livestock occurred in 24.0 POS, PFWP could not be calculated because no correction factors were available.

When dividing the prairie region into the westcentral and northwest study areas, small mammals were more common in the westcentral area (88.0 POS, 74.5 PFWP) whereas medium-sized mammals were more common in the northwest (56.0 POS, 43.6 PFWP) (Table 2). In the prairie areas, deer/pronghorn remains were found only in samples analyzed in the northwest study area.

<table>
<thead>
<tr>
<th>Study area</th>
<th>Food item</th>
<th>N</th>
<th>POS(^a)</th>
<th>PFWP(^b)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black Hills</td>
<td>Mammals</td>
<td>99</td>
<td>99.0</td>
<td>99.2</td>
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<td></td>
<td>Small-sized mammals</td>
<td>76</td>
<td>76.0</td>
<td>25.3</td>
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<td>Lagomorphs</td>
<td>6</td>
<td>6.0</td>
<td>0.9</td>
</tr>
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<td></td>
<td>Medium-sized mammals</td>
<td>25</td>
<td>25.0</td>
<td>8.6</td>
</tr>
<tr>
<td></td>
<td>Deer/pronghorn</td>
<td>55</td>
<td>55.0</td>
<td>64.4</td>
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<td></td>
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<td>2</td>
<td>2.0</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>Birds</td>
<td>8</td>
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<td></td>
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<td>5</td>
<td>5.0</td>
<td>—</td>
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<tr>
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<td>46</td>
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<td>Lagomorphs</td>
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<td>10.0</td>
<td>8.4</td>
</tr>
<tr>
<td></td>
<td>Medium-sized mammals</td>
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<td>38.0</td>
<td>34.0</td>
</tr>
<tr>
<td></td>
<td>Deer/pronghorn</td>
<td>2</td>
<td>4.0</td>
<td>9.2</td>
</tr>
<tr>
<td></td>
<td>Livestock</td>
<td>12</td>
<td>24.0</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>Birds</td>
<td>11</td>
<td>22.0</td>
<td>11.3</td>
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<td></td>
<td>Invertebrates</td>
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<td>28.0</td>
<td>2.5</td>
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<tr>
<td></td>
<td>Vegetation</td>
<td>31</td>
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</tr>
<tr>
<td></td>
<td>Unknown</td>
<td>5</td>
<td>10.0</td>
<td>—</td>
</tr>
</tbody>
</table>

\(^a\) POS = (# times food item occurs / total # of fecal piles examined) x 100.
\(^b\) PFWP was calculated using ratio and kg per scat estimators derived from coyote feeding trial data (Kelly 1991).
\(^c\) No PFWP correction factors were available for livestock, vegetation, or unknown food items.
Because POS (or frequency of occurrence) depends on the amount of food eaten, it tends to be more meaningful when reported with volume or weight expressed as a percentage of the sample (Korschgen 1980). Even though frequency data provide important information by measuring how pervasive a food item is in a diet, researchers tend to assume that frequency with which an item occurs within a scat corresponds to the amount of that item consumed. As prey species get larger, less of their mass consists of non-flesh components and therefore, fewer fecal samples are produced per unit weight (Kelly 1991). In other words, when using POS, small prey are overrepresented in biomass and underrepresented in numbers compared with larger prey. Kelly and Garton (1997) stressed the need for future consideration of the relationship between prey consumption and subsequent digestion. Additionally, Kelly and Garton (1997) cautioned against using the number of teeth or diagnostic bones to determine the number or amount of a prey represented by a fecal sample without addressing the variability in their recovery. Due to the variability in the recovery of bone and teeth and the lack of variability in the recovery of

Table 2. Annual percent-of scats (POS) and percent-fresh-weight-of-prey (PFWP) of food items found in coyote fecal samples collected February to October 1998 in west-central and northwest prairie regions of western South Dakota.

<table>
<thead>
<tr>
<th>Study area</th>
<th>Food item</th>
<th>N</th>
<th>POS</th>
<th>PFWP</th>
</tr>
</thead>
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<tr>
<td></td>
<td>Mammals</td>
<td>24</td>
<td>96.0</td>
<td>85.7</td>
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<td>Small-sized mammals</td>
<td>22</td>
<td>88.0</td>
<td>74.5</td>
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<td>Lagomorphs</td>
<td>2</td>
<td>8.0</td>
<td>0.6</td>
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<td></td>
<td>Medium-sized mammals</td>
<td>5</td>
<td>20.0</td>
<td>10.6</td>
</tr>
<tr>
<td></td>
<td>Deer/pronghorn</td>
<td>0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td></td>
<td>Livestock</td>
<td>9</td>
<td>36.0</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>Birds</td>
<td>3</td>
<td>12.0</td>
<td>14.1</td>
</tr>
<tr>
<td></td>
<td>Invertebrates</td>
<td>4</td>
<td>16.0</td>
<td>0.2</td>
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<td></td>
<td>Vegetation</td>
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<td>0.0</td>
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<td>Northwest</td>
<td>Mammals</td>
<td>22</td>
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<td>86.5</td>
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<td></td>
<td>Small-sized mammals</td>
<td>11</td>
<td>44.0</td>
<td>18.2</td>
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<td></td>
<td>Lagomorphs</td>
<td>3</td>
<td>12.0</td>
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<td>Medium-sized mammals</td>
<td>14</td>
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<td>43.6</td>
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<td>8.0</td>
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<td></td>
<td>Livestock</td>
<td>3</td>
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<td></td>
<td>Birds</td>
<td>8</td>
<td>32.0</td>
<td>10.1</td>
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<td>10</td>
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<tr>
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<td>—</td>
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</table>

^ POS = (# times food item occurs / total # of fecal piles examined) x 100.

^ PFWP was calculated using ratio and kg per scat estimators derived from coyote feeding trial data (Kelly 1991).

^ No PFWP correction factors were available for livestock, vegetation, or unknown food items.
hair, we used teeth and bone to identify small rodents in coyote fecal samples, and then used a visual estimate of hair to apportion the fecal sample to the prey present as suggested by Kelly and Garton (1997).

Similar to other studies (Bowyer et al. 1983, Andelt et al. 1987, and Brillhart and Kaufman 1994), mammals were the most frequently occurring food item in coyote diets in all study areas located in western South Dakota. Also, the PFWP correction factors indicated that mammals comprised the majority of biomass in coyote diets in western South Dakota. In the Black Hills, small-sized mammals were the most common prey item. However, deer comprised the largest part of coyote diets. The POS results of this study were similar to those reported for other studies in western Montana (Reichel 1991) and in Yellowstone National Park (Murie 1940) in that voles were the most common coyote prey item. Also, MacCracken and Hansen (1987) and Ogle (1971) suggested that voles were more important than lagomorphs and/or deer in coyote diets. Hamlin et al. (1984) concluded that voles were a common food source for coyotes in eastern Montana only during years of high vole populations. Conversely, mice were a common food item in Minnesota (Berg and Chesness 1978) and the northwest prairie of South Dakota during our study. Andrews and Boggess (1978) concluded that mice, birds, and plants were most common in coyote diets during summer months in Iowa. Birds did not seem to be a major food source for coyotes in western South Dakota, nor were they in Minnesota (Berg and Chesness 1978). Fruits were common in coyote diets during berry ripening season in Minnesota and western South Dakota.

Other studies conducted in the Black Hills (MacCracken and Uresk 1984), southwestern North Dakota (Lewis et al. 1994), Nebraska (Huebschman et al. 1997), southwestern Oklahoma (Litvaitis and Shaw 1980), eastern Kansas (Brillhart and Kaufman 1994), and southwestern Colorado (Gese et al. 1988) demonstrated that deer were the most common food item of coyotes. Our results suggest that deer were not necessarily the most common prey item in the Black Hills, although they comprised the largest part of the total fresh weight of prey consumed. Most studies suggest that deer were more commonly found in fecal samples in late winter and spring, rodents during summer and fall, and insects and fruits in late summer and fall (MacCracken and Uresk 1984, Reichel 1991, Brillhart and Kaufman 1994, Huebschman et al. 1997). Berg and Chesness (1978) concluded that coyotes were more likely to take adult deer in January-March and fawns in April-July. Although deer were not the most frequent food item in western South Dakota, they were the second most frequent and interestingly, comprised the greatest part of coyote diets in the Black Hills based on PFWP correction factors. Small and medium-sized mammals comprised the greatest part of coyote diets in the prairie region based on PFWP correction factors.

Effects of predators on prey populations are determined in part by numerical (i.e., changes in reproduction, survival, immigration) and functional (i.e., changes in kill rates) responses to prey densities (Solomon 1949). Shifts in prey type and predation pressure may occur because of prey switching or other optimal foraging patterns (Patterson et al. 1998). These shifts may occur when the focus of a predator is switched from one prey type to another only
after the “new” prey species becomes more abundant and provides more profitable hunting, or when numbers of the primary prey are low. Coyotes generally feed opportunistically on smaller mammals such as fawns of small ungulates, lagomorphs, and mice-size rodents (Kleiman and Brady 1978). However, in the presence of livestock, some coyotes may become efficient predators of domestic sheep (Connolly et al. 1976). Nevertheless, despite their presence, cattle and other livestock remains were negligible in fecal samples collected in study areas located in the Black Hills and other studies in this region (Lewis et al. 1994, MacCracken and Uresk 1984).

Compared to the Black Hills, deer/pronghorn were less frequent and small and medium-sized mammals more frequent in coyote diets in the northwest prairie. Reduction in the consumption of deer/pronghorn in the northwest prairie could be related to a decline in their abundance following the severe winter of 1996. Pronghorn numbers were reduced after the winter of 1996 (Schlueter 1999) such that coyotes may have switched their focus to more abundant and profitable prey, (i.e., small and medium-sized mammals). According to species richness data (V. Smith, South Dakota State University, Brookings, SD, unpublished data), small mammal diversity was moderate in the northwest prairie, moderate to high in the westcentral prairie, and highest in the Black Hills. Although we did not identify all food items to species, we did find at least 5 different species of small mammals in each of the study areas. Furthermore, because of low relative density indices of coyotes in the northwest prairie, group hunting for larger prey such as deer and pronghorn may have been more difficult; thus smaller prey may have been more profitable. Bowen (1981) indicated that packs were more successful than pairs or single coyotes in catching larger prey such as deer and that coyote group size increased in winter when large ungulates were in the diet.

Deer comprised the majority of coyote diets in the Black Hills but the lowest in the westcentral prairie. One possible explanation may be the high relative density indices of coyotes (Gerads 2000) and vulnerability of a declining white-tailed deer population in the Black Hills (Griffin 1994, DePerno et al. 2000). DePerno et al. (2000) stated that natural mortality (i.e., from coyotes, dogs, malnutrition, and sickness) of female white-tailed deer in the Black Hills was 71% with annual survival rates ranging from 50.3 to 62.1%. Conversely, Grassel (2000) concluded that existing forage quality was not limiting deer in the Missouri River Breaks region of westcentral South Dakota with annual survival ranging from 74.0 to 85.0%. This suggests that poorly nourished and weak deer in the Black Hills might be more susceptible to predation than were healthier deer in the westcentral prairie. Furthermore, coyotes will often take advantage of vulnerable deer (Hilton 1978) particularly in winter months. Perhaps with high coyote relative density indices and vulnerable deer in the Black Hills, coyote hunting strategies have been modified (e.g., group hunting). Patterson (1994) suggested that a critical factor in determining coyote killing rates of deer was their response to deer density and vulnerability. Unfortunately, it is impossible to determine if deer and livestock remains in coyote fecal samples are the result of direct predation or scavenging. However, anecdotal observations indicate that most coyote mortalities on adult deer in the Black Hills occur immediately post spring migration.
We were unable to investigate the numerous factors that can affect coyote foraging strategy and intensity of depredation in western South Dakota. Gier (1968) and Lemm (1973) stated that coyotes tend to attack more domestic livestock and poultry while raising young during summer months. In central Alberta, Todd and Keith (1976) demonstrated a positive relationship between coyote densities in winter and availability of dead livestock on agricultural land. Although food habits changed significantly between seasons, Bowyer et al. (1983) noted that coyote numbers did not change significantly suggesting coyotes are opportunistic feeders. We suggest that differences in coyote relative densities as well as vulnerable prey may explain differences in diets among our study areas. In addition to predator densities, habitat types, social status, prey abundance, and snow depth and hardness can significantly influence prey detection and hunting success by coyotes (Gese et al. 1996). Reichel (1991) suggested that even generalist predators would adjust their hunting strategies to accommodate local conditions.

**MANAGEMENT RECOMMENDATIONS**

Because ranching and hunting are important in South Dakota, ranchers and sportsmen are especially concerned with predation on livestock and game species. Increased concern toward predators by ranchers and wildlife managers coincides with increasing predator densities. Knowledge of abundance indices or trends in population abundance is useful for developing management programs and for understanding species ecology (Knowlton 1984). Relative density is an index of population abundance that may become useful to managers as multiple years of data are collected. This allows managers to monitor long-term seasonal and annual population trends. For instance, by using these indices, biologists may be able to monitor changes in density, reproduction, and/or predator-prey interactions.

Use of Program Scat 1.5 (Kelly 1991) provided a statistically valid representation of prey consumed by coyotes in various areas of western South Dakota. An accurate representation of prey consumed should prove worthwhile in helping to elucidate the underlying mechanisms of predator-prey dynamics. Future research needs to focus on all factors affecting coyote feeding strategies, including numerical and functional responses, social structure, prey abundance, detection and capture rates, habitat types, environmental conditions, and interspecific interactions. Furthermore, relationships between predator species, their food habits, and their influence on prey should be investigated to better understand and manage the community as a whole. Alternate prey population levels and cycles should be determined prior to decisions about whether or not to control coyotes to increase prey populations. Feeding trials are needed to develop applicable correction factors for larger prey items, e.g., elk, bison, cattle, and combinations of prey encountered in field conditions. It is important that the relationship between prey item recovered in fecal samples and the actual prey consumed be understood (Kelly 1991) before topics such as opportunistic feeding, optimal forage, competition among
carnivores, and responses to changes in prey density can be addressed. Answering these types of questions can provide a more complete understanding of predator ecology and ultimately contribute to more efficient predator management strategies (Knowlton 1972).

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LITERATURE CITED


