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Annual Diet of Bobcats in Oregon's Cascade Range

Abstract

Because little information exists on the role of the bobcat (*Felis rufus*) as a predator in coniferous forest ecosystems, this study was initiated to determine the annual diet of bobcats in the coniferous forest of Oregon's Cascade Range. Diet was determined from analysis of 494 scats. Dominant prey species identified were snowshoe hares (*Lepus americanus*), black-tailed deer (*Odocoileus hemionus*), and mountain beaver (*Aplodontia rufa*); remains of these species occurred in 30 percent, 22 percent, and 12 percent of scats examined, respectively. A variety of cricetid and sciurid rodents, birds, insectivores, and reptiles were also identified. The greatest diversity in the seasonal diet of bobcat occurred during spring, while the least diversity occurred during winter. Mean prey size taken by bobcats in the spring (426 g) was approximately half during winter (827 g). Diets of bobcats were most dissimilar between winter and spring. The variety of prey taken seasonally by bobcats and the wide range in prey size indicate the potential for competition with other predators. Knowledge of the seasonal variation in the bobcat diet should allow wildlife managers to more effectively manage both bobcats and their potential prey species.

Introduction

Little information is available concerning bobcat food habitats in coniferous forests of the Pacific Northwest. Several authors reported on small samples from the Coast Range of western Oregon (Schwartz and Mitchell 1945, Sweeney 1978, Witmer and deCalestra 1986); only Nussbaum and Maser (1975) reported bobcat diet in the Cascade Range. This paper reports on the annual and seasonal diet of bobcats from the central Cascade Range of western Oregon.

Study Area

This study was conducted in Oregon's Cascade Mountain Range, within the Willamette National Forest approximately 55 km east of Eugene, Lane County, Oregon (43° 55' N; 122° 30' W). Terrain was abruptly dissected by drainages of the North Fork of the Middle Fork Willamette River. Elevations range from about 500 m to 1,500 m. Climate was typical of the Western Cascade maritime area with mild, wet winters and warm, dry summers. Precipitation occurred about 160 days per year and averaged about 150 cm annually. Mean annual snowfall averaged about 163 cm; the latest date with 150 cm of snow usually occurred in late March (Lahey 1979). Annual temperature extremes ranged from -18 to 38°C.

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Vegetation was typical of the Western Hemlock (*Tsuga heterophylla*) Zone as described by Franklin and Dyrness (1973). Logging, reforestation projects, and forest fires have resulted in a dominance of Douglas-fir (*Pseudotsuga menziesii*) with smaller, isolated stands of western red cedar (*Thuja plicata*). Grand fir (*Abies grandis*), Pacific silver fir (*Abies amabilis*), western yew (*Taxus brevifolia*), and western white pine (*Pinus monticola*) occurred commonly. Understories were dominated by creambrush oceanspray (*Holodiscus discolor*) on dry sites, Pacific rhododendron (*Rhododendron macrophyllum*) and Cascade hollygrape (*Berberis nervosa*) on intermediate sites, and sword fern (*Polystichum munitum*) and Oregon oxalis (*Oxalis oregana*) on mesic sites (Franklin and Dyrness 1973).

Methods

Scats were collected on the study area from 15 October 1982 through 30 June 1984. All roads on the 280 km² study area were cleared of scats prior to initiation of daily collections so that only fresh material was collected. Each scat was labeled and air dried prior to separation and identification of prey remains. Prey items in some of the scats were separated from other undigested residues as collected, but bones were separated from most scats using an 8 percent (2M) solution

of NaOH to digest the associated conglomerate (Green *et al.* 1986). Samples of hair were removed from scats prior to NaOH digestion for comparison with hair keys (Mayer 1952, Stains 1958, Adorjan and Kolenosky 1969) to aid in prey species identifications. Bones in the scats were identified by comparison with skeletal materials in the vertebrate museum of the Department of Fisheries and Wildlife, Oregon State University.

Each scat was subjected to a three-part identification procedure. Each scat was identified to species in both the field and the laboratory based on color, texture, odor, and (in the field) associated tracks and scrapes. A portion of each scat was subjected to thin-layer chromatography for identification of bile acid residues present (Major *et al.* 1980, Johnson *et al.* 1981, Johnson *et al.* 1984). Chromatography was used to derive final identification where other characteristics were not definitive.

Similarity indices (SI) between seasonal diets were calculated according to Horn (1966); using the index, values could range between zero (no food items in common between seasons) and 1 (identical diets between seasons).

Mean prey size was calculated seasonally for all species identified from bobcat scats and weighted by frequency of occurrence. This calculation provided a slight over-estimate of mean prey size since several specimens of small prey of the same species in a single scat were recorded as one occurrence, as was a single specimen of larger size. Ungulate remains were excluded from these calculations since many may have been eaten as carrion. Weights of adult mammals were taken from Maser *et al.* (1981) and from weights recorded for museum specimens at Oregon State University. Mammal nomenclature follows Jones *et al.* (1982); plant nomenclature follows Garrison *et al.* (1976).

Results

Four hundred ninety-four bobcat scats were analyzed (Table 1). Snowshoe hares (*Lepus americanus*), black-tailed deer (*Odocoileus hemionus*), and mountain beaver (*Aplodontia rufa*) were the food items most commonly identified. Hares made up the largest portion of the diet throughout the year and occurred in > 33 percent of scats during fall and winter. Second in frequency of occurrence was black-tailed deer,

occurring in 22 percent of scats examined (Table 1). Deer remains occurred in 27 percent of fall and 31 percent of winter scats, and were the most frequently identified prey item during December and January, when they occurred in 46 percent of bobcat scats. Black-tailed deer were the second most abundant prey in the bobcat diet during February, March, April, and May (Table 1). Remains of fawns were identified from a single bobcat scat collected in May, from 6 scats (8%) in June, 8 (18%) from July, and 1 (2%) from August. Fawns accounted for 11, 55, 6, and 17 percent of all deer remains identified from bobcat scats collected in May, June, July, and August, respectively. In July, black-tailed deer remains (fawns and adults) were the most frequently identified food item. Remains of calf elk (*Cervus elaphus*) were identified in four bobcat scats from June and July.

Mountain beaver were the third-ranking item in bobcat diets, and occurred in greatest frequency during spring (16%) and summer (17%) months. Cricetid rodents of 9 species (Table 1) occurred in 23 percent of the scats, varying from 9 percent in winter to 37 percent in spring. Six species of sciurid rodents (Table 1) comprised 17 percent of the bobcat diet. Squirrels were eaten by bobcats most frequently in the fall (28%) and least frequently in the summer (11%). Insectivores were found in 17 percent of bobcat scats during spring months, but did not occur in scats from other seasons (Table 1). The most frequently identified insectivore, the coast mole (*Scapanus orarius*), occurred in 13 (7%) spring scats.

Remains of birds occurred in 47 (10%) scats. Most were passerines, but only 1 slate-colored junco (*Junco hyemalis*) and 11 ruffed grouse (*Bonasa umbellus*) could be positively identified. Eggshell fragments occurred in 5 scats. Reptile remains occurred in 9 percent of spring scats. Like insectivores, reptiles occurred in the bobcat diet only during spring (Table 1).

Masticated green grass was found in 55 (11%) of the scats, and some scats consisted solely of grass. On two occasions, freshly passed scats that consisted solely of masticated grass and entwined tapeworms were found. Blackberries (*Rubus* sp.), huckleberries (*Vaccinium* sp.), Cascade holly-grape (*Berberis nervosa*), and manzanita (*Arctostaphylos* sp.) were identified in 33 (7%) scats. In each instance, fruit was associated with other, animal prey and may represent food of other

TABLE 1. Prey items identified from 494 bobcat scats from Oregon's Cascade Range. Values are number of occurrences; percent frequency of occurrence follows.

Prey Item	Jan-Mar		Apr-Jun		July-Sep		Oct-Dec		Annual	
	(N=112)		(N=187)		(N=105)		(N=90)		(N=494)	
	No.	Percent	No.	Percent	No.	Percent	No.	Percent	No.	Percent
MAMMALS										
<i>Odocoileus hemionus</i>	35	31	30	16	20	19	24	27	109	22
<i>Cervus elaphus</i>	5	4	4	2	2	2	4	4	15	3
<i>Spilogale gracilis</i>	0	0	1	1	0	0	1	1	2	—
<i>Canis latrans</i>	0	0	2	1	0	0	0	0	2	—
<i>Lepus americanus</i>	43	38	48	26	29	28	30	33	150	30
<i>Ochotona princeps</i>	2	2	4	2	8	8	1	1	15	3
<i>Aplodontia rufa</i>	9	8	30	16	18	17	0	0	57	12
<i>Thomomys mazama</i>	1	1	10	5	10	10	2	2	23	5
<i>Castor canadensis</i>	1	1	0	0	0	0	0	0	1	—
<i>Glaucomys sabrinus</i>	5	4	1	1	1	1	10	11	17	3
<i>Tamiasciurus douglasii</i>	8	7	6	3	1	1	3	3	18	4
<i>Tamias townsendii</i>	2	2	11	6	5	5	7	8	25	5
<i>Tamias amoenus</i>	2	2	3	2	1	1	0	0	6	1
<i>Spermophilus beecheyi</i>	0	0	3	2	1	1	2	2	6	1
<i>Spermophilus lateralis</i>	0	0	2	1	1	1	1	1	4	1
Unknown Sciurid	1	1	1	1	2	2	2	2	6	1
<i>Neotoma cinerea</i>	3	3	5	3	1	1	2	2	11	2
<i>Peromyscus maniculatus</i>	2	2	13	7	4	4	3	3	22	4
<i>Clethrionomys</i>										
<i>californicus</i>	2	2	6	3	2	2	1	1	11	2
<i>Arborimus albipes</i>	0	0	2	1	0	0	0	0	2	—
<i>Zapus trinotatus</i>	0	0	5	3	5	5	0	0	10	2
<i>Ondatra zibethica</i>	0	0	2	1	1	1	1	1	4	1
<i>Microtus oregoni</i>	0	0	13	7	1	1	1	1	15	3
<i>Microtus richardsoni</i>	0	0	4	2	1	1	2	2	7	1
<i>Microtus longicaudus</i>	1	1	4	2	1	1	0	0	6	1
Unknown cricetid	2	2	16	9	6	6	2	2	26	5
<i>Scapanus orarius</i>	0	0	13	7	0	0	0	0	13	3
<i>Scapanus townsendii</i>	0	0	2	1	0	0	0	0	2	—
<i>Neurotrichus gibbsii</i>	0	0	4	2	0	0	0	0	4	1
<i>Sorex trowbridgii</i>	0	0	6	3	0	0	0	0	6	1
<i>Sorex vagrans</i>	1	1	4	2	0	0	0	0	5	1
<i>Sorex monticolus</i>	0	0	1	1	0	0	0	0	1	—
<i>Sorex</i> sp.	0	0	1	1	0	0	0	0	1	—
Unknown Mammal	6	5	16	9	7	7	8	9	37	7
BIRDS										
<i>Bonasa umbellus</i>	1	1	3	2	3	3	4	4	11	2
<i>Junco hyemalis</i>	0	0	0	0	0	0	1	1	1	—
Unknown Passerine	7	6	9	5	10	10	4	4	30	6
Eggshell	0	0	4	2	1	1	0	0	5	1
REPTILES										
<i>Sceloporus occidentalis</i>	0	0	8	4	0	0	0	0	8	2
<i>Eumeces skiltonianus</i>	0	0	1	1	0	0	0	0	1	—
<i>Diadophis punctatus</i>	0	0	1	1	0	0	0	0	1	—
<i>Thamnophis</i> sp.	0	0	1	1	0	0	0	0	1	—
Unknown Snake	0	0	6	3	0	0	0	0	6	1
INSECTS										
	0	0	4	2	0	0	1	1	5	1
FRUIT										
	3	3	1	1	25	24	4	4	33	7

animals ingested by bobcats. Human refuse including plastic sandwich bags, cotton cloth, and paper was found in 5 scats.

Fall and winter diets were most similar (SI = 0.942), comprised primarily of snowshoe hares, black-tailed deer, and a variety of sciurid and cricetid rodents (Table 2). Bobcat diets changed in the spring. Spring diets included all prey eaten during fall and winter, along with increased frequency of mountain beaver, western pocket gophers (*Thomomys mazama*), microtines, cricetines, and birds. Insectivores and reptiles occurred in the spring diet only. The variety of prey identified in the bobcat diet increased from 17 during the winter to 35 during the spring (Table 3). Mean prey size during spring averaged 426 g (Table 3), about half that during winter (827 g). Winter and spring diets were the most dissimilar (SI = 0.759) of any seasonal comparison (Table 2). The second-greatest change in bobcat diet between successive seasons occurred between summer and fall (Table 2). Percentages of snowshoe hares, black-tailed deer, and sciurids in the bobcat diet increased from summer to fall, with decline in use of mountain beaver, mice, and birds. Despite the difference in seasonal diet indicated by a low SI value (0.779), the number of

kinds of prey (21 in summer, 19 in fall) and mean prey size (529 g in summer and 539 g in fall) were nearly identical.

Discussion

Lagomorphs are important prey in bobcat diets throughout the United States (McCord and Cardoza 1982) as well as in eastern Oregon (Towell 1982), several portions of the Coast Range (Schwartz and Mitchell 1945, Nussbaum and Maser 1975) and in the Cascade Range (Nussbaum and Maser 1975, this study). Mountain beaver dominated bobcat diets in some (typically low-elevation) portions of the Coast Range (Sweeney 1978, Witmer and deCalesta 1986).

The frequency of occurrence of black-tailed deer in the diet of bobcats in the Cascade Range was unexpected because of the size differential of the two species (approximately 6.0 kg vs. 68 kg). Many authors have attributed remains of deer found in bobcat food habit studies to scavenging (Hamilton and Hunter 1939, Rollings 1945, Pollack 1951, Erickson 1955, Progulske 1955, Gashwiler *et al.* 1961). In this study, remains of deer in bobcat scats occurred primarily during the fawning period and again during the winter, when alternate prey was probably least available. However, the high incidence of deer in the bobcat diet during periods when alternate prey availability was believed to be low leads to speculation that bobcats may prey on deer, as has been suggested by others (Marston 1942, Westfall 1956, McCord 1974, Beasom and Moore 1977, Fritts and Sealander 1978). The ability of bobcats to kill adult as well as fawn deer has been well documented (see McCord and Cardoza 1982). Major changes in bobcat diet between warm and cold seasons (winter/spring SI = 0.759; summer/fall SI = 0.779), were noted in this study. These changes were associated with a steady seasonal decline in prey diversity and increase in weighted mean prey size from spring through winter (Table 3).

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TABLE 2. Pair-wise diet similarity indices for bobcats in Oregon's Cascade Mountain Range.

Season	Winter	Spring	Summer	Fall
Spring	0.759	—	—	—
Summer	0.779	0.803	—	—
Fall	0.942	0.770	0.779	—
Annual	0.906	0.935	0.906	0.919

TABLE 3. Variety of prey and weighted mean size of prey identified from 494 bobcat scats collected from Oregon's Cascade Range.

	Season			
	Winter	Spring	Summer	Fall
Variety of Prey ^a	17	35	21	19
Weighted Mean Prey Size (g) ^b	827	426	529	539

^aFrom Table 1.

^bUngulates excluded.

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