

Population Characteristics and Food Habits of Bobcats in West Virginia

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Abstract: The age structure of 227 bobcats (*Lynx rufus*) collected from hunters and trappers in West Virginia during the 1977-78 season was dominated by young animals. Juveniles and yearlings constituted 46.7% and 23.3% of the sample respectively. All females >1 year old had ovulated and had 4.0 ± 0.2 ($\bar{X} \pm SE$) current year luteal bodies. Yearlings had 1.75 ± 0.27 placental scars, which was significantly less ($P < 0.05$) than the 3.4 ± 0.4 of 2-year-olds or the 2.63 ± 0.27 of bobcats ≥ 3 years old. White-tailed deer (*Odocoileus virginianus*) and lagomorphs comprised 45% and 19% of the stomach contents by weight, respectively.

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The status of the bobcat (*Lynx rufus*) in West Virginia has recently been elevated as a result of changing social and economic values. The bobcat received legal status as a game species in West Virginia in 1977 and today is considered a valuable furbearer and prized trophy. The West Virginia Department of Natural Resources (DNR) initiated studies on the bobcat to examine population characteristics and to evaluate the levels of parasites and disease in the population. This study investigated the age structure, reproduction, and food habits of bobcats harvested in West Virginia during the 1977-78 season. Studies completed by Oertley and Walls (1980) and Watson et al. (1981) have evaluated parasites and infectious agents. We gratefully acknowledge the assistance of R. Hall of the West Virginia DNR and Drs. V. Nettles, F. Kellogg, and F. Hayes of the Southeast Cooperative Wildlife Disease Study at the University of Georgia. Dr. R. Brocke, K. Gustafson, and D. Kenyon of the State University of New York, College of Environmental Science and Forestry, Syracuse, New York assisted in numerous aspects of the study.

Methods

Bobcat carcasses were collected from hunters and trappers during the 31 October 1977 to 28 February 1978 season by DNR personnel. The carcasses were kept frozen until they could be necropsied. The majority of the carcasses came from the Allegheny Plateau, Allegheny Ridges and Valleys, and Cumberland Mountain physiographic provinces within West Virginia.

Age was estimated by tooth eruption patterns, size of canine apical root foramen in relation to the date of kill, and cementum deposition patterns (Crowe 1975). All bobcats <1 yr old are referred to as juveniles. Tooth sectioning was performed at the Delmar Wildlife Resources Center, New York State Department of Environmental Conservation, following the procedures of Stone et al. (1975).

Female reproductive tracts were preserved in a 10% solution of buffered formalin. Ovaries were sectioned with a razor blade at 1 to 2-mm intervals and examined macroscopically. Luteal bodies were categorized into either current season corpora lutea (Duke 1949) or luteal bodies of previous cycles (Crowe 1975) based on color. Uteri were examined with transmitted light and then opened and examined with reflected light to detect placental scars.

Food items were identified either by comparing structural macrofragments with a reference collection, or microscopically with guard hair medulla and scale pattern keys (Adorjan and Kolenosky 1969, Moore et al. 1974).

Means are presented with plus or minus 1 standard error. Comparisons of means have been made with Student's *t* test adapted for equal and unequal variance depending upon the sample variances. Chi-square tests were used to compare frequency distributions (goodness of fit) and Yate's correction was used with 2×2 contingency tables (Sokal and Rohlf 1969).

Results

Harvest Age Structure

The harvest age structure of bobcats taken in West Virginia was dominated by young animals as 70% of the sample were animals <2 years old. The oldest individual was a 17.5-year-old male. The total sample consisted of 201 usable carcasses and 26 lower jaws. No significant differences ($P > 0.05$) were detected in the age structure of male ($N = 100$) and female ($N = 101$) components of the sample (Table 1). The age structure of bobcats harvested by hunters was similar to the age structure of bobcats harvested by trappers.

Table 1. Harvest Age Structure (% in Each Age Class) of Bobcats in West Virginia, 1977-78

Age Class	Sex		Method of Take	
	Males (N = 101)	Females (N = 100)	Hunting (N = 57)	Trapping (N = 102)
0- 1	46.5	47.0	45.6	44.1
1- 2	22.8	26.0	26.3	25.5
2- 3	6.9	6.0	5.3	7.8
3- 4	5.9	8.0	8.8	5.9
4- 5	5.0	4.0		7.8
5- 6	3.0	4.0	3.5	3.9
6- 7		1.0		
7- 8	2.0	2.0	3.5	1.0
8- 9	3.0	1.0	1.8	2.0
9-10	1.0	1.0		2.0
10-11	1.0		1.8	
11-12				
12-13	1.0			1.0
13-14	1.0		1.8	
14-15				
15-16				
16-17				
17-18	1.0		1.8	

Reproduction

Reproduction tracts from 100 females were examined. All juveniles ($N = 47$) lacked both luteal bodies and placental scars. All bobcats older than 1 year had ovulated as indicated by luteal bodies. The number of corpora lutea were similar for all age groups, averaging 4.0 ± 0.2 . The implantation rate of yearlings averaged 1.75 ± 0.27 and was significantly lower ($P < 0.05$) than either 2-year-olds (3.4 ± 0.4) or animals ≥ 3 years old (2.63 ± 0.27) (Table 2). The primary reason for this difference was that 5 of 24 (21%) yearlings showed no sign of implantation, whereas only 1 of 24 (4%) bobcats ≥ 2 years old lacked placental scars.

Table 2. Reproductive Characteristics of Female Bobcats in West Virginia, 1977-1978

Age	Corpora Lutea			Placental Scars		
	N	Mean	SE	N	Mean	SE
1-2	26	3.92	0.32	24	1.75	0.27
2-3	5	4.80	0.73	5	3.40	0.40
≥ 3	22	3.91	0.29	19	2.63	0.27

Food Habits

The food items present in 172 bobcat stomachs were identified and weighed (Table 3). White-tailed deer (*Odocoileus virginianus*) was the principal food item, occurring in 49.4% of the stomachs and accounting for 45.3% of the total prey weight. Lagomorphs, primarily *Sylvilagus* spp., constituted the second most important prey category, comprising 18.9% of the total prey weight. Small rodents were the second most frequently encountered prey item, occurring in 38.4% of the stomachs. However, small rodents comprised only 5.3% of the prey by weight.

Table 3. Fall and Winter Food Habits of Bobcats in West Virginia as Determined from 172 Stomachs Collected during the 1977-78 Hunting and Trapping Season

Food Item	% Occurrence	% Weight
White-tailed deer (<i>Odocoileus virginianus</i>)	49.4	45.3
Cottontail rabbit (<i>Sylvilagus</i> spp.)	12.2	16.5
Unidentified hare or rabbit (Leporidae)	11.0	2.4
Total rabbits and hare	23.3	18.9
Squirrels (<i>Sciurus</i> spp.)	8.1	9.4
Red squirrel (<i>Tamiasciurus hudsonicus</i>)	2.3	1.0
Eastern chipmunk (<i>Tamias striatus</i>)	2.3	2.1
Flying squirrel (<i>Glaucomys</i> spp.)	0.6	0.3
Total squirrels	13.4	12.6
Mouse (<i>Peromyscus</i> spp.)	9.9	1.3
Southern red-backed vole (<i>Clethrionomys gapperi</i>)	9.3	1.5
Southern bog lemming (<i>Synaptomys cooperi</i>)	2.9	0.7
Vole (<i>Microtus</i> spp.)	2.9	0.5
Unidentified Cricetidae	20.3	1.4
Total small rodents	38.4 ^a	5.3
Woodchuck (<i>Marmota monax</i>)	4.1	2.9
Eastern woodrat (<i>Neotoma floridana</i>)	0.6	1.0
Muskrat (<i>Ondatra zibethicus</i>)	1.2	2.3
Total large rodents	5.8	6.2
Virginia opossum (<i>Didelphis virginiana</i>)	5.2	2.4
Raccoon (<i>Procyon lotor</i>)	1.2	0.1
Red fox (<i>Vulpes vulpes</i>)	0.6	3.2
Housecat	0.6	0.1
Total omnivores	7.6	5.9
Short-tailed shrew (<i>Blarina brevicauda</i>)	1.7	0.4
Shrews (<i>Sorex</i> spp.)	3.5	0.1
Total shrews	4.7 ^b	0.5
Ruffed grouse (<i>Bonasa umbellus</i>)	3.5	2.3
American coot (<i>Fulica americana</i>)	0.6	0.9
Flycatcher (Tyrannidae)	0.6	—
Other birds	4.7	0.8
Total birds	9.3	4.0
Other	4.1	1.3

^a Twelve bobcats had more than 1 species of small rodent in their stomach.

^b One bobcat had eaten a short-tailed shrew and a *Sorex* spp.

Table 4. Percent Occurrence of Food Categories in the Stomachs of Bobcats from West Virginia, 1977-78

Food Category ^a	Sex		Age		
	Males (N = 87)	Females (N = 83)	Juveniles (N = 81)	Yearlings (N = 38)	Adults (N = 51)
Deer	48.3	51.8	50.6	52.6	47.1
Rabbits & hares	21.8	25.3	25.9	21.1	21.6
Squirrels	9.2	16.9	16.0	10.5	9.8
Small rodents	29.2	47.0	39.5	42.1	33.3
Large rodents	8.0	2.4	3.7	7.9	5.9
Omnivores	9.2	6.0	8.6	2.6	9.8
Shrews	6.9	2.4	9.9	—	—
Birds	5.7	12.0	11.1	5.3	7.8
Other	4.6	3.6	2.5	5.3	5.9

^a Species included in each category are identified in Table 3.

Females utilized small rodents to a significantly greater degree ($P < 0.05$) than males (Table 4). This difference was not detectable among juveniles but yearling and adult females consumed small rodents more frequently than yearling and adult males ($P < 0.05$).

The high occurrence of deer in the stomachs of bobcats from West Virginia does not appear to be due to trap bait. There was no significant difference ($P > 0.05$) between the food habits of bobcats taken by hunters and the rest of the sample. Deer occurred in the stomachs of 49% of 55 bobcats taken by hunters. The occurrence of deer in the diet increased significantly ($P < 0.01$) from 24% of 29 bobcats taken before 21 November 1977 (rifle season for deer) to 55% of 143 bobcats after that date.

Discussion

The harvest age structure of West Virginia bobcats includes a high proportion of juveniles (46.7%) and yearlings (23.3%). Similar harvest age structures have been reported from Minnesota, Kansas and South Dakota (Berg 1979, Johnson 1979, Fredrickson and Rice 1979). However, no conclusions about the West Virginia population should be drawn from this age structure without additional information. Numerous problems in interpreting age structure have been identified (Caughley 1974). Harvest age structures are further complicated by the unknown magnitude of age and sex vulnerabilities to harvest.

The harvest of bobcats in West Virginia increased from 548 during the 1977-78 season to 588 during the 1978-79 season and 602 during the 1979-80 season. The distribution of the harvest, based on the number of bobcats taken in each county, remained relatively stable.

Reproductive rates of bobcats in West Virginia are similar to those reported for bobcats in Arkansas (Fritts and Sealander 1978b). They reported mean corpora lutea counts of 4.2 and placental scar counts of 2.5, whereas we observed 4.0 ± 0.2 ($N = 53$) corpora lutea and 2.3 ± 0.2 ($N = 48$) placental scars. They also observed that some females, especially yearlings, ovulated but apparently failed to implant. The pattern of ovulation without implantation has been reported to be as high as 64% for yearlings and 44% for 2-year-olds in eastern Idaho (Bailey 1979).

Food habits have been the most commonly studied aspect of bobcat ecology. Yet little information is available on the diets of sex and age class components of the population. Our data support the findings of Fritts and Sealander (1978a) as we were also able to detect a greater utilization of small rodents by females than by males. Shrews were consumed only by juvenile bobcats in West Virginia.

Utilization of deer by bobcats in West Virginia was higher than that previously reported elsewhere. Deer was documented as the most common food item in some New England studies of bobcats (Hamilton and Hunter 1939, Westfall 1956, Stevens 1966). Bobcats have been implicated as an important predator of deer in the southeast (Barick 1969). However, prior to this study rabbits and small rodents were reported as the most prevalent food items of bobcats in the southeast (Progulske 1955, Buttrey 1974, Kitchings and Story 1979). Deer was present in 14.1% of the fall-winter bobcat scats examined by Progulske (1955), 38.9% of the 34 scats examined by Buttrey (1974), and 20% of 10 scats examined by Kitchings and Story (1979). Our findings do not indicate whether deer were taken by predation or as carrion, but suggest an increased emphasis on deer as a food item after deer hunting season opens. This study indicated that deer were an important food item for bobcats further south than had been previously reported.

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