

Food Choices by Northern Bobwhites in Illinois

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ABSTRACT

Food choices of the northern bobwhite (*Colinus virginianus*) were determined by evaluating 209 crops collected between 1 November 2003 and 15 January 2004 in Clay, Richland, and Wayne Counties of southern Illinois. Plant materials composed 98.9% of the volume and animal matter 1.1%. Grit occurred in 6.2% of the crops, and 14.4% of the crops were empty. Only 5 food items made up 1.0% or more by volume. These included soybean 56.8%, corn 34.1%, acorn 1.4%, sorghum 1.2%, and leaves 1.1%. The 5 food items with the highest frequency of occurrence were soybean 47.9%, corn 40.7%, leaves 40.7%, slugs 14.8%, and ragweed 8.1%.

INTRODUCTION

The northern bobwhite (*Colinus virginianus*) is a game bird well studied throughout its wide range (Brennan 1991, Roseberry 1979, Weber et al. 2002). The bobwhite is an early successional species and prefers the moderately disturbed habitat provided by activities like farming and the Conservation Reserve Program (Roseberry and Klimstra 1984). However, the bobwhite continues to decline in distribution and abundance in Illinois. Estimated hunter harvest of bobwhite in Illinois have decreased from 2,503,000 in 1956 to 844,000 in 1994 and 263,292 in 2004 (Roseberry and Cole 2006). Wildlife managers seek to determine the best food and cover to meet the bobwhite's survival needs. Continued study of the bobwhite during all seasons in various habitats is important, as every new piece of knowledge contributes to the conservation of the bobwhite.

The objectives of this project were to (1) determine the main food choices of bobwhites, and (2) compare food choices in each month of the hunting season. Research findings were then compared with results of a previous study (Larimer 1960) on bobwhite food choices in Illinois. He collected 4606 bobwhite crops in 1950 and 1951 from the 34 southernmost counties of Illinois. Farming practices have changed since 1950, with an increase in soybeans and sorghum and a decrease in wheat and hay; therefore, we hypothesized that bobwhite food choices had changed as well. In 1950, the hunting season only lasted from 11 November to 11 December, and the farmland in southern Illinois

counties consisted of the following: 20-31% corn, 9-6% soybeans, 4-20% wheat, and 5-9% hay (Larimer 1960).

Our study focused on 3 counties: Clay, Richland, and Wayne Counties. According to the Illinois Department of Agriculture (2003), Clay County farmland is 46% soybeans, 28.9% corn, 3.8% wheat, 2.6% hay, 1.3% sorghum, and 17.4% other. Richland County farmland is 49.8% soybeans, 36% corn, 5.2% wheat, and 9% other. Wayne County farmland is 41.2% soybeans, 25.4% corn, 3.2% wheat, 4.4% sorghum, and 25.8 % other. Wayne produces more sorghum than any other county in Illinois. Corn appears to have stayed relatively stable over the years.

The average growing season in southern Illinois, from the last spring frost to the first fall frost, is approximately 200 days. The mean minimum temperatures for this study area are 7°C during fall and -5°C during winter. The mean maximum temperatures are about 18°C during fall and 3°C during winter. Southern Illinois has a mean annual rainfall of 116.8 cm, and winter, with a mean precipitation of 25.4 cm, is the driest season (Hollinger 2003).

MATERIALS AND METHODS

Bobwhite crops were collected from hunters between 1 November 2003 and 15 January 2004, in Wayne, Richland, and Clay Counties. Data from all counties were pooled. Materials given to the hunters included a permanent marker, freezer bags, information tags, and a sheet of instructions. The tags were small squares of durable paper with a string tied through a hole in the paper. Each tag asked for the date, time, location, and sex of the bird harvested. While hunting in the field, hunters filled out the appropriate information and tied the tag onto the leg of the bobwhite. When the hunters got home and cleaned their birds, they removed the tags and extracted the crops. They placed each crop and its respective tag into a bag and then froze the sample. Unfortunately, because of the limitations on how the crops were collected, post-mortem digestion might have caused a misrepresentation of vegetation and invertebrates. Given that invertebrates are not generally eaten by gallinaceous birds in the winter, the effect on the data should have been minimal.

Crops were analyzed after the hunting season. Tag information was recorded, and after thawing, the crop was cut open and its contents were separated into like groups. Each group was placed into a graduated cylinder and measured using the water displacement method. Any unknown contents were placed in a separate bag to be identified later. Landers and Johnson (1976) and Uva and others (1997) were helpful resources for identifying seeds commonly eaten by bobwhites. Southern Illinois University and the Cooperative Wildlife Research Laboratory also provided assistance in identifying seeds.

Plant and animal nomenclature was based on Larimer's findings (1960) to facilitate comparison between the two studies. Seeds were identified to the species level if possible, but leaf material was simply labeled as "leaves." Recognizable animal parts were identified to the order, and in some cases, the family level. Some plant and animal materials were labeled as "unknown." Grit volume was measured the same as described above. Some crops were recorded as empty. For each food, percent frequency of occurrence and per-

cent volume of total crop contents were calculated as described by Larimer (1960). In short, frequency of occurrence is the number of crops in which the food was found divided by the total number of crops. The percent volume of a food is determined by dividing the total volume of that food by the total volume of all crop contents. The volumes of food categories in our study were compared to Larimer's (1960) using a Fisher Exact Test. We also compared volumes of foods in the crops between the months using a Fisher Exact Test (Sokal 1969). For both tests a p value of less than 0.05 was considered to indicate a significant difference.

RESULTS

Out of 209 crops, 34 different food items were identified (Table 1), of which 98.9% were plant materials and 1.1% were animal material. The legume family, Leguminosae, made up 57.1% of the volume of all crop contents, and the grass family, Graminae, made up 36.8%. All animal material was identified to the orders Insecta and Gastropoda. Grit occurred in 6.2% of the crops, and 14.4% of the crops were empty. Only 5 food items made up 1.0% or more by volume. These included soybeans 56.8%, corn 34.1%, acorns 1.4%, sorghum 1.2%, and leaves 1.1%. The 5 food items with the highest frequency of occurrence were soybeans 47.9%, corn 40.7%, leaves 40.7%, slugs 14.8%, and ragweed 8.1%.

Findings by Larimer (1960) were compared to the top 15 food choices from this study (Table 2). Food choices of bobwhites harvested during the 3 months were compared (Table 3). In November, 52 crops were collected, 108 in December, and 49 in January.

Using the Fisher Exact Test, we compared the top 4 foods by volume from Larimer's study (1960) with our study. We found a significant difference in soybean (G adjusted = 21.9, df = 1, p value <0.001), acorn (G adjusted = 4.6, df=1, p value of 0.03), and lespedeza (G adjusted = 11.9, df=1, p value < 0.001).

Using the Fisher Exact Test, we also tested the difference in November, December, and January foods. We found a significant difference in November corn compared to January corn (G adjusted = 7.6, df=1, p value = 0.006). Also, there was a significant difference between December and January soybeans (G adjusted = 18.9, df=1, p value < 0.001).

DISCUSSION

In 1950 and 1951, Larimer (1960) found that cultivated grains, including corn, soybean, and wheat, comprised nearly 56% of the bobwhite's diet. In this study, cultivated grains comprised 92% of the diet. This suggests a change in the food availability of the bobwhite in Illinois over the past 50 years. We would expect this given the changes in agricultural practices in the state in the same time period.

Within this study, differences were present between the 3 months of the hunting season. In November, corn ranked above soybeans in percent volume, but soybean ranked first during the other 2 months. Cultivated grains (corn, soybean, and sorghum) made up 83.5% of food items in November, but that increased to 94.3% in both December and January.

The importance of this change in diet from past studies and within the winter months of our study may be more behavioral than physiological. More time spent in open fields feeding on waste grain exposes the bobwhite to more predators and more winter elements. Previous studies have shown 70% of waste soybeans and 40% of waste corn disappearing by late fall (Dec.1) in Illinois agricultural fields. By early spring (April 1), only 15% of waste soybeans are left in these fields (Warner et al. 1989), meaning the bobwhite is forced to forage longer to obtain its needed energy requirements. When cold-stress is added to this equation, survival in the Illinois' winter agricultural landscape may be arduous.

As we've stated, the importance of cultivated grains to bobwhites has increased in the past fifty years. This increase may not be a choice but a result of limited options. A decline of the bobwhite across the state of Illinois (Kleen 2004, Roseberry and Cole 2006) suggests this change in bobwhite foraging activity may be detrimental. Fencerows along fields or nearby woody patches may be essential for bobwhites to escape predation. Although microhabitats are integral, consideration of landscape structure is necessary when assessing habitat suitability (Weber et al. 2002). An adequate combination of food and cover is essential for survival. More research is needed to determine if the changing food availability or the change in cover are responsible for the decline of the bobwhite in Illinois.

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Table 1. Percent volume and percent frequency of occurrence of all foods in crops.

Food Group	% Volume	% Frequency of occurrence
Legume family (Leguminosae)		
Soybean (<i>Glycine max</i>)	56.84 (1)	47.85 (1)
Small wild bean (<i>Strophostyles leiosperma</i>)	0.17 (14)	2.39 (21)
Lespedezas (<i>Lespedeza</i>)	0.04 (21)	1.91 (22)
Grass family (Graminae)		
Corn (<i>Zea mays</i>)	34.14 (2)	40.67 (2)
Sorghum (<i>Sorghum</i>)	1.22 (4)	3.83 (15)
Switchgrass (<i>Panicum virgatum</i>)	0.61 (9)	8.13 (6)
Smooth crabgrass (<i>Digitaria ischaemum</i>)	0.34 (12)	3.35 (19)
Faber's foxtail (<i>Setaria faberii</i>)	0.02 (23)	4.31 (13)
Wheat (<i>Triticum aestivum</i>)	0.01 (27)	0.48 (34)
Barnyard grass (<i>Echinochloa crusgalli</i>)	0.01 (27)	0.96 (27)
Unknown gramineae seed	0.41 (11)	4.31 (13)
Beech family (Fagaceae)		
Oak acorns (<i>Quercus</i>)	1.40 (3)	5.74 (10)
Honeysuckle family (Caprifoliaceae)		
Japanese honeysuckle (<i>Lonicera japonica</i>)	0.80 (6)	6.70 (8)
Composite family (Compositae)		
Common ragweed (<i>Ambrosia elatior</i>)	0.69 (7)	8.13 (6)
Cashew family (Anacardiaceae)		
Poison ivy (<i>Rhus radicans</i>)	0.29 (13)	1.91 (22)
Spiderwort family (Commelinaceae)		
Dayflower (<i>Commelina diffusa</i>)	0.16 (16)	5.26 (12)
Buckwheat family (Polygonaceae)		
Climbing false buckwheat (<i>Polygonum scandens</i>)	0.05 (18)	1.91 (22)
Pennsylvania smartweed (<i>Polygonum pennsylvanicum</i>)	0.01 (27)	0.48 (34)
Amaranth family (Amaranthaceae)		
Pigweed (<i>Amaranthus</i>)	0.02 (23)	3.83 (15)
Mallow family (Malvaceae)		
Prickly sida (<i>Sida spinosa</i>)	0.02 (23)	3.83 (15)
Rose family (Rosaceae)		
White avens (<i>Geum canadense</i>)	0.01 (27)	1.44 (25)
Pine family (Pinaeaceae)		
Red cedar (<i>Juniperus virginiana</i>)	0.01 (27)	0.96 (27)
Leaves	1.07 (5)	40.67 (2)
Unknown Materials	0.49 (10)	12.92 (5)
Grit Slugs & Snails (Gastropoda)	0.04 (21)	6.22 (9)
Slugs (Philomycidae)	0.69 (7)	14.83 (4)
Amber snails (Succinia)	0.01 (27)	0.96 (27)
Insects (Insecta)		
Short-horned grasshoppers (Acrididae)	0.17 (14)	1.44 (25)
Orthoptera parts (Orthoptera)	0.01 (27)	0.96 (27)
Beetles (Coleoptera)	0.12 (17)	5.74 (10)
Ants (Formicidae)	0.05 (18)	3.35 (18)
Hymenoptera parts	0.02 (23)	2.39 (21)
Hemiptera parts	0.01 (27)	0.96 (27)
Flies (Diptera)	0.05 (18)	0.96 (27)
Animal parts	0.01 (27)	3.83 (15)

Table 2. Top 15 food items in this study compared to Larimer's study.

Food Item	This study (2004)		Food Item	Larimer (1960)	
	% Volume	% Frequency of occurrence		% Volume	% Frequency of occurrence
Soybeans	56.84	47.85	Corn	27.79	28.85
Corn	34.14	40.67	Soybeans	22.43	22.08
Acorns	1.40	5.74	Lespedezas	8.66	42.23
Sorghum	1.22	3.83	Acorns	7.19	9.55
Leaves	1.07	40.67	Wheat	5.45	4.54
Japanese honeysuckle	0.80	6.70	Ragweed	4.58	26.40
Slugs	0.69	14.83	White sassafras	3.80	5.23
Ragweed	0.69	8.13	Desmodium	2.94	12.11
Switchgrass	0.61	3.35	Slugs	2.81	6.84
Grass seed	0.41	4.31	Jewelweed	1.82	8.66
Smooth crabgrass	0.34	3.35	Bidens	1.38	18.98
Poison ivy	0.29	1.91	Cowpea	1.36	1.73
Small wild bean	0.17	2.39	Grasshoppers	1.32	4.54
Grasshoppers	0.17	1.44	Small wild bean	1.00	12.53
Dayflower	0.16	5.26	Yellow foxtail	0.86	9.12

Table 3. Comparison by months of top ten food items consumed by bobwhites in Clay, Richland, and Wayne Counties, 2003-2004.

November (52 crops)		December (108 crops)		January (49 crops)	
Food Item	% Volume	Food Item	% Volume	Food Item	% Volume
Corn	40.09	Soybeans	58.58	Soybeans	69.66
Soybeans	39.14	Corn	35.22	Corn	24.37
Acorns	4.28	Ragweed	0.93	Leaves	2.72
Sorghum	4.28	Switchgrass	0.81	Slugs	1.24
Japanese honeysuckle	2.53	Leaves	0.71	Acorns	0.90
Grass seed	1.96	Acorns	0.64	Japanese honeysuckle	0.35
Slugs	1.63	Sorghum	0.53	Sorghum	0.30
Smooth crabgrass	1.62	Japanese honeysuckle	0.38	Beetles	0.16
Grasshoppers	0.87	Small wild bean	0.28	Grass seed	0.06
Poison ivy	0.71	Poison ivy	0.24	Dayflower	0.05

