

FOOD HABITS OF THE RACCOON (*PROCYON LOTOR*) AT LAND BETWEEN THE LAKES

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ABSTRACT

Food habits of the raccoon, *Procyon lotor* (Linnaeus) 1758, were studied at Land Between The Lakes in Stewart County, Tennessee, and Trigg and Lyon counties, Kentucky. One hundred and forty-three raccoons (72 males; 71 females) were examined from December 1980 through November 1981. Food items, percent occurrence, and percent volume were determined for each season. Of the major food items recorded, insects, corn, persimmons, and acorns were found to differ significantly in occurrence over seasons. Occurrence of principal food items did not exhibit significant differences between sexes or among age classes. Volumetrically, insects were the only food found to differ significantly over seasons. Significant differences for food volumes did not exist between sexes; only corn volume was found to be significantly different among age classes, with older animals having a higher volume. Overall, results indicated raccoons to be opportunistic feeders and reflected local strategies for utilization of available resources.

INTRODUCTION

The raccoon (*Procyon lotor*) is a medium-sized carnivore which ranges extensively throughout North America. The species feeds on a varied assortment of foods and may be found in habitats ranging from climax forest communities to residential areas of large cities. At a time when many specialist species are stressed to survive, the raccoon appears to continue to colonize new areas. A generalist strategy toward food resources has probably played an important role in the livelihood of *P. lotor* throughout its distribution.

An understanding of food habits is critical to management decisions relating to the species. While numerous food habit studies have been conducted (see Lotze and Anderson, 1979; Kaufmann, 1982), information concerning feeding strategies of *P. lotor* are lacking

for many regions within its range. Since food utilization tends to vary between geographic areas, food habit information gathered in one area may not be applicable to other areas. With the exception of Baker et al. (1945) and Johnson (1970), few comprehensive studies of raccoon food habits have been conducted in the southeastern United States. No detailed investigations of the food habits of *P. lotor* have been carried out in Tennessee and Kentucky. The purpose of this study was to examine raccoon food habits at a localized site in western Tennessee and western Kentucky.

MATERIALS AND METHODS

The study was conducted at Land Between the Lakes (LBL) in Stewart County, Tennessee (USA) and Trigg and Lyon counties, Kentucky (USA). The area was a 69,000 ha peninsula between Kentucky Lake on the west and Lake Barkley to the east. Elevation was between 109 and 171 meters. The area was relatively gravelly; soils were infertile and formed moderate to steep slopes. Habitat was predominantly upland hardwood forest associated with extensive shoreline. Roughly 85% or about 58,700 ha, was made up of forest, with approximately 88% being of the oak-hickory type. Remaining areas (approximately 10,120 ha) were managed as meadows, croplands, and reverting fields. Approximately 2,000 ha of cropland has been planted in corn, soybeans and wheat annually.

Raccoons were obtained from December 1980 through November 1981. Most animals were collected by gun with the use of dogs or spotlighting from a boat or truck. Animals were aged following Junge and Hoffmeister (1980) and sexed.

Procedures for analyzing digestive tracts follow those of Korschgen (1969). Food items were analyzed on the basis of percent occurrence (frequency of stomachs containing an item) and percent volume (frequency of an item in stomachs). Plants were identified with the aid of Ellis and Chester (1980).

Biometric routines were employed from the Statistical Package for the Social Sciences of Nie et al. (1975). Chi-square was used to examine food occurrences between seasons, age groups, sexes, and localities (= counties within the study area). Food volumes were tested in relation to age, sex, and locality with Kendall's tau, Pearson's *r*, and Chi-square, respectively. All significance tests were at the $P < 0.05$ level. Computer analyses were conducted at Memphis State University.

RESULTS

One hundred and forty-three raccoons (72 males; 71 females) were examined. Specimens were taken over different seasons (those of the calendar year) in the following numbers (male sample size given first): spring—20, 15; summer—27, 25; fall—17, 18; winter—8, 13. Animals were aged as juvenile ($N = 12$), subadult ($N = 8$), adult ($N = 5$), or old adult ($N = 26$). Combined plant material and combined animal material constituted 59% and 41%, respectively, of total food volume (Table 1). As expressed by percent occurrence and percent volume, insects were the most common food item. Seven other items (corn, persimmons, crayfish, fish, mussels, earthworms, grasses) had percent occurrences greater than 5.0. Three additional items (persimmons, fish, blackberries) had percent volumes greater than 5.0. When compared based on percent occurrence, major food items did not exhibit significant differences between sexes or among age classes; however, insects and corn did differ significantly when tested across localities. Volumetrically, no significant differences were detected between sexes or localities. Only corn volume was found to be significantly different among age classes with older animals having a higher volume. Of these major food items, insects, corn, persimmons, and acorns were the only foods found to differ significantly across seasons in percent occurrence or percent volume (Table 2). The highest percentage of digestive tracts containing insects (percent occurrence) was from summer specimens, while the lowest was from winter. Mayflies and grasshoppers were the predominant insects present in digestive tracts during spring and summer. Grasshoppers were eaten mainly during spring. Corn occurrence reached a peak during summer and fall when it was most available. Persimmons were taken primarily in the fall. Of the tracts which contained acorns, most were from spring. Average total food volume was lowest during winter and highest in summer. During late spring, summer, and fall, there was an increase in plant materials consumed, especially those with high sugar content such as berries. Volumetrically, corn, persimmons, red cedars, blackberries, black cherries, wheat, pokeberries, summer

Table 1. Foods found in 143 raccoons from Land Between The Lakes in Stewart County, Tennessee, USA, and Lyon and Trigg Counties, Kentucky, USA.

Food	Occurrence	% Occurrence	Volume (mL)	% Volume
Insects	120	82.8	1247	24.0
Corn	36	24.8	956	18.8
Persimmons	30	20.7	655	12.9
Crayfish	19	13.1	39	0.8
Fish	18	12.4	341	6.7
Mussels	12	8.3	19	0.4
Earthworms	9	6.2	61	1.2
Grasses	8	5.5	14	0.3
Summer Grapes	7	4.8	38	0.7
Blackberries	6	4.1	266	5.2
Acorns	5	3.4	76	1.5
Black Cherries	4	2.8	220	4.3
Wheat	4	2.8	155	3.1
Pokeberries	4	2.8	138	2.7
Centipedes	4	2.8	4	0.1
Frogs	3	2.1	225	4.4
Red Cedars	3	2.1	117	2.3
Song Birds	3	2.1	34	0.7
Rodents	3	2.1	30	0.6
Snakes	3	2.1	8	0.2
Spiders	3	2.1	5	0.1
Muscadines	2	1.4	140	2.8
Winterberries	2	1.4	45	0.9
Comm. Hackberries	2	1.4	25	0.5
Salamanders	2	1.4	6	0.1
Shrews	1	0.7	55	1.1
Sugar Hackberries	1	0.7	40	0.8
Soybeans	1	0.7	40	0.8
Firethorns	1	0.7	40	0.8
Silverberries	1	0.7	25	0.5
Greenbriars	1	0.7	15	0.3
Bitterweeds	1	0.7	1	0.1

grapes, and muscadines comprised the largest part of the plant material. Insects occurred in the greatest volume and, when examined over seasons, were the only food to differ significantly, with highest volumes occurring in summer and spring.

DISCUSSION

Results indicate LBL raccoons are opportunistic feeders with food selection depending on season of the year. Like many previous studies conducted over larger geographic areas (Baker et al., 1945; Schoonover and Marshall, 1951; Stains, 1956; Johnson, 1970), the present investigation showed combined plant material to constitute the majority of food volume as opposed to

total animal volume. No published information on food habits of raccoons in Tennessee and Kentucky is available for comparison with the current study. However, comparisons with investigations of Baker et al. (1945), Johnson (1970), Fleming et al. (1978), and Harman and Stains (1979) reveal little congruence in overall and seasonal utilization of foods by raccoons at LBL and other areas of the southeastern United States. Prominence of insects in our study can be explained by resource availability due to an environment suitable to grasshoppers (old and agricultural fields) and mayflies (shoreline of Kentucky Lake and Lake Barkley). Fish utilization was made possible by the shorelines of adjacent bodies of permanent water. Annual mast crop surveys conducted by Tennessee Valley Authority (TVA) personnel indicated that mast production was low (1.14 kg/ha) during the study period (unpubl. rep., TVA, Golden Pond, KY, 1982). This could account in part for this depressed acorn occurrence.

The significantly higher volume of corn found in older animals may be due to different foraging behavior or preferred foods between age groups. The significantly

sugar content; however, foods easily acquired, such as mayflies and fish, were also eaten. During times of scarcity, raccoons were less selective and consumed whatever resources were available.

While food items detected in our study have been reported in most other studies, the utilization of these items appear to vary between geographic areas and among seasons. As in the studies of Fleming et al. (1978) and Harman and Stains (1979), food items reported in the present investigation illustrate local strategies for taking advantage of available resources. Without local investigation, the importance of insects and fish as a food resource at LBL could well have been underestimated. Such items may not be predicted from studies conducted over larger regions (large portions of states, states, or regions). A great deal of information can be drawn from large scale studies (e.g., Stuewer, 1943; Baker et al., 1945; Stains, 1956; Johnson, 1970); however, an awareness of food utilization at a local level appears critical to decision making relating to management questions of raccoons from specific areas.

Table 2. Raccoon foods found to vary significantly across seasons. Sample sizes were as follows: Spring = 35, Summer = 52, Fall = 35, and Winter = 21.

Food	Percent Occurrence			
	Spring	Summer	Fall	Winter
Insects	88.6	92.3	80.0	57.0
Corn	5.7	28.8	45.7	9.5
Persimmons	2.9	23.1	40.0	14.3
Acorns	11.4	0.0	2.9	0.0

Food	Percent Volume			
	Spring	Summer	Fall	Winter
Insects	43.9	28.3	3.8	12.1

higher volume of insects in summer and spring coincides with mayfly abundance. Low average total food volume in winter and high volume in summer corresponds with food availability being lowest in winter and higher in summer. Given the increase in spring, summer, and fall of items high in sugar (presumably high in energy), raccoons appeared to be taking sweet items over other available foods but not to their exclusion. This result is similar to that summarized by Johnson (1970). During times of food abundance, raccoons were fairly selective with preferences for items with high

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