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AGE SPECIFIC ANALYSIS OF FOOD HABITS FOR ARKANSAS RACCOONS (*PROCYON LOTOR*)

Raccoons are omnivorous and have been categorized as solely opportunistic in their feeding habits. Fruits, insects, acorns, and crayfish are normally the main dietary constituents during fall and winter (Johnson, 1970). Hamilton (1936) examined 127 raccoon stomachs taken during the fall and winter from the New York area. Plant material (acorns, fruits, etc.) comprised 73.8%; animal foods (small mammals, insects, crayfish, etc.) represented 26.1%, the remaining 1.5% was garbage. Giles (1939 and 1940) collected scats and stomachs of raccoons from central and eastern Iowa. Plant material made up over 70% of the total with animals and insects representing the remaining food items found. In eastern Texas, Baker et al. (1945) studied the food habits of raccoons from September 1940 through June 1942. During this period, a total of 378 scats, stomachs, and intestinal tracts were analyzed. Over the entire year, plant foods exceeded animal foods by 40 to 60 percent. Acorns (Quercus) and crayfish (Cambarus) were the two principal foods revealed by their study, comprising more than half the total volume taken. Both items appeared in the diet during every month. During the winter, acorns averaged more than half of the total volume taken. Rivest and Bergeron (1981) in a two year study of raccoon food habits found that plants made up 96% of food items. This may be somewhat biased toward plants since the study was conducted in an area where corn was the major field crop.

The purpose of the present study is to describe the winter food habits of male and female raccoons from different age classes and from the various physiographic regions of Arkansas.

The geographical scope of this study included all habitats within the political boundaries of Arkansas. Foti (1974) divides Arkansas into four major physiographic regions: the Ozarks, Ouachitas, Mississippi Alluvial Plain (Delta), and Gulf Coastal Plain (GCP). The Ozark Mountains lie in the northwestern region of the state, with the Ouachita Mountains to the south and the Mississippi Alluvial Plain to the east. The Ouachita Mountains lie between the Ozark Mountains to the north, the Gulf Coastal Plain to the south and Mississippi Alluvial Plain to the east. The Mississippi Alluvial Plain, occupies the eastern portion of the state, and is bounded to the southwest by the Gulf Coastal Plain and to the west and northwest by the Ouachita and Ozark Mountains. The Gulf Coastal Plain lies in southern Arkansas, contacting the Ouachita Mountains along its northwestern and the Delta along its northeastern boundaries. These four physiographic regions form the geographic framework of this study.

Carcasses utilized in this study were collected from furbuyers and trappers during the regular Arkansas trapping seasons of 1981-82 and 1982-83. Trapping seasons in Arkansas generally extend from about 1 December through 31 January, with a two-week grace period in February for furbuyers to complete their business transactions. Stomach collection data for the 1981-82 and 83-84 trapping seasons. For each carcass, the skull was removed and tagged as a museum specimen, and stomachs were removed, tagged, and frozen (Korschgen, 1971) for later examination. A lower canine was extracted for cemental analysis. Analysis of dental cementum is a widely accepted method for age determination for many mammals. Grau et al. (1970) found that the canine foramen closes at approximately 12 months of age in raccoons. For this reason, teeth having an open root tip, were considered to be less than one year of age and taken no further in the aging process. All teeth having a closed root tip were processed according to the celloidin technique described by Tumlison and McDaniel (1983).

Of the 1427 raccoon stomachs collected, 607 contained no food items or only debris consumed while in the trap, and are not included in this study. The 820 remaining stomachs were grouped according to region, sex, and age. Food items were grouped into six categories (acorns, non-acorns, terrestrial and aquatic vertebrates, insects and other invertebrates). When more than one food item was found in a particular stomach, each item was considered to have equal value and, therefore, additively contributed to unity (i.e., if there were four items in a stomach, each was considered to represent 1/4 of the whole or 0.25% of one).

Because over 70% of the stomachs collected were from raccoons of less than one year of age, ages have been reduced to individuals that are either less than one year of age (<1) or those that are over one year of age (>1). Table 1 shows these percentages for both age classes. The ratio of males to females is a little more even with males making up 55% and females being 45% of the total (Table 1).

In the stomachs of the two age classes that contained plant material, acorns made up 50% or more of the total, the only exception being the Delta region (Table 2). In all regions raccoons <1 year old consumed a higher percentage of acorns than animals >1 year, except in G.C.P. where the situation was reversed slightly. Stomachs from raccoons of the Delta reflected a higher usage of aquatic vertebrates than other regions, with animals >1 year using aquatic vertebrates more than the <1 year olds. Stomachs from the Ozarks and the G.C.P. reflecting the opposite by higher usage of terrestrial vertebrates by animals older than 1 year. The Ouachita region demonstrated almost even usage between terrestrial and aquatic vertebrates, with animals <1 year eating more terrestrials and animals >1 year eating more aquatic vertebrates. Insects and other invertebrates seemed to be consumed equally between the two age classes for all regions (Table 2).

Table 1. Percentages for male and female racoons and both age classes for the geographical regions of Arkansas.

Region	Age	# in Group	%	Sex	# in Group	%
Delta	<1	121	83	♂	82	57
	>1	24	17	♀	63	43
Ozark	<1	94	69	♂	67	49
	>1	42	31	♀	69	51
Ouachita	<1	189	77	♂	134	54
	>1	58	23	♀	113	46
G.C.P.	<1	215	74	♂	172	60
	>1	77	26	♀	120	40
Total	<1	619	75	♂	455	55
	>1	201	25	♀	365	45

Table 2. Percent of food items consumed by raccoons of both age classes (< or> 1 year) for the four geograhic regions of Arkansas.

Region	Age	Acorns	Non Acorns	Total Plants	Tres. Verts.	Aqu. Verts.	Total Verts.	Insects	Other Invert.	Total Invert.
Delta	<1	36	49	85	15	27	42	7	7	14
	>1	21	42	63	17	38	55	13	13	26
Ozark	<1	56	31	87	13	7	20	21	7	28
	>1	33	33	66	17	14	31	17	12	29
Ouachita	<1	71	15	86	11	5	16	10	10	20
	>1	57	9	66	9	12	21	22	16	38
G.C.P.	<1	66	27	93	8	3	11	22	15	37
	>1	68	21	89	17	8	25	26	23	49

Females in all regions demonstrate a higher usage of acorns than males. Raccoons from the Delta showed a preference for aquatic vertebrates, with raccoons from the Ozark and G.C.P. regions using terrestrial vertebrates to a higher degree. Ouachita males consumed more aquatic vertebrates and females more terrestrial vertebrates. Raccoons of both sexes did not demonstrate a preference for either insects or other invertebrates, except for females in the Ozarks and G.C.P. regions which consumed a greater proportion of insects than other invertebrates (Table 3). Raccoons generally use food in proportion to their availability as demonstrated Schoonover and Marshall (1951) and Johnson (1970). Results reflect what appears to be a degree of selectivity rather than a purely opportunistic feeding strategy.

Table 3. Percent of food items consumed by raccoons of both sexes for the four geographic regions of Arkansas.

Region	Sex	Acorns	Non Acorns	Total Plants	Tres. Verts.	Aqu. Verts.	Total Verts.	Insects	Other Invert.	Total Invert.
Delta	♂	31	49	80	20	29	49	7	6	13
	♀	71	13	84	10	29	39	10	11	21
Ozark	♂	43	34	77	15	12	27	16	12	28
	♀	55	29	84	13	7	20	23	6	29
Ouachita	♂	67	17	84	7	10	17	11	13	24
	♀	69	9	78	14	3	17	14	10	24
G.C.P.	♂	66	25	91	13	5	18	20	19	39
	♀	67	25	92	4	3	7	28	16	44

LITERATURE CITED

BAKER, R.H., C.C. NEWMAN, and F. WHITE. 1945. Food habits of the raccoon in eastern Texas. J. Mammal. 9:45-48.

FOTI, T.L. 1974. Natural divisions of Arkansas. In Arkansas natural area plan. Arkansas Dept. Planning. Little Rock, AR. pp. 11-34.

GILES, L.W. 1939. Fall food habits of the raccoon in central Iowa. J. Mammal. 20:68-70.

_____. 1940. Food habits of the raccoon in eastern Iowa. J. Wildl. Manage. 4:375-382.

GRAU, G.A., G.C. SANDERSON, and J.P. ROGERS. 1970. Age determination of raccoons. J. Wildl. Mgmt. 34:364-372.

HAMILTON, W.J., JR. 1936. The food and breeding habits of the raccoon. Ohio J. Sci. 36:131-140.

JOHNSON, A.S. 1970. Biology of the raccoon (Procyon lotor hirtus Nelson and Goldman) in Alabama. Bull. Auburn Univ. Agric. Exp. Sta. 402:1-148.

KORSCHGEN, L.J. 1971. Procedures for food habits analyses. In wildlife management techniques. 3rd ed. The Wildlife Society, Washington, DC. pp 233-250.

RIVEST, P. and J.M. BERGERON. 1981. Density, food habits, and economic importance of raccoons (Procyon lotor) in Quebec agrosystems. Can. J. Zool. 59:1755-1762.

SCHOONOVER, L.J., and W.H. MARSHALL. 1951. Food habits of the raccoon (Procyon lotor hirtus) in north-central Minnesota. J. Mammal. 32: 422-428.

TUMLISON, R. and V.R. MCDANIEL. 1983. A reliable celloidin technique for dental cementum analysis. J. Wildl. Mgmt. 47:274-278.

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DEVELOPMENT OF A VARIABLE WAVELENGTH FLAME INFRARED EMISSION GAS CHROMATOGRAPHY DETECTOR

All matter above absolute zero, whether solid, liquid, or gas, continually absorbs and re-emits radiation due to the thermal agitation of its molecules, and is classified as a non-selective (blackbody or graybody) or selective radiator. Non-selective radiators emit a continuous spectral curve which has a maximum emittance at a specific wavelength which varies with temperature. Most heated solids behave as this kind of radiator. Selective radiators, such as hot gases and flames, emit radiation only over specific wavelength intervals depending on the molecular or atomic composition of the source (Fig. 1). Because the spectral lines or bands at certain wavelengths reveal the spectral characteristics of a selective radiator, they may be used for detection and analytical identification and are widely used in the determination of the functional components of organic compounds.

Different methods have been employed to determine the composition of compounds quantitatively or qualitatively. For example, the gravimetric procedure can be used for the determination of carbon and hydrogen (Ma and Ritter, 1975). Mass spectrometry procedures, in which charged particles are sorted according to their mass/charge ratio, give excellent information about molecular weight and structure. Nuclear Magnetic Resonance and the Infrared Absorption methods, such as FT, and dispersive, IR give significant organic functionality information (Willard, *et al.* 1988).

Combustion flames have been widely employed in detection systems for chromatography, either as spectroscopic sources as in the case of flame photometric detectors or as ionization cells as in the case of flame ionization detection. However, a recently developed method using combustion flames is flame infrared emission (FIRE) detection. Carbon dioxide (CO_2) and water vapor (H_2O) IR emissions can be monitored in order to make carbon and hydrogen determinations. In the range of 2 to 5 μm, CO_2 emits the strongest band centered at 4.4 μm, while H_2O emits a band at 2.7 μm (Fig. 2) (Plyler, 1948). This use of IR emission has great potential usefulness since about 20% of the energy from a flame is emitted in this region compared to about 0.4% for the visible spectrum. For transparent flames such as the hydrogen/air flame, the visible emission is negligible and most of the radiated energy falls in the infrared region of the spectrum.