

## Environmental Contaminants in Raccoons in Kansas

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Environmental contaminants are a continuing source of concern. In an effort to monitor the presence of these substances and assess the threats they present to wildlife, a joint study was conducted in 1985 between the Kansas Fish and Game Commission and the Kansas Department of Health and Environment.

Raccoons (Procyon lotor) were selected as the study animal because this species frequently utilizes aquatic environments for their food sources. They have relatively restricted home ranges and they are nonmigratory. Environmental contaminants found in the adipose tissues of raccoons reflect the presence of the contaminants in the immediate vicinity.

Prior to this study, the Central Flyway Technical Committee had requested that member states initiate sampling programs to identify possible sources of contamination. Their immediate concerns were due to contaminants found in waterfowl in Montana. Migratory behavior of most waterfowl renders them inferior to nonmigratory species as study animals to detect regional difference in environmental contaminants. Layher et al. (1985) sampled pheasants (Phasianus colchicus) in Kansas in an effort to document pesticide levels available to field feeding species of wildlife.

### MATERIALS AND METHODS

Raccoon carcasses were collected during the 1984-85 fur harvest season (November 21, 1984 - January 31, 1985) from eight locations. Raccoons were collected from fur dealers and furharvesters in the following cities and represent

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specimens taken in proximity to the listed water bodies or streams: (1) Ark City, Arkansas River below Wichita; (2) Great Bend, Cheyenne Bottoms wetland; (3) Downs, tributaries to Waconda Lake (Glen Elder Reservoir); (4) Valley Falls (tributaries to Perry Reservoir); (5) Blue Rapids, Big Blue and Little Blue rivers; (6) Pratt, South Fork of the Ninnescah River; (7) Emporia, Cottonwood and Neosho rivers above John Redmond Reservoir; and (8) Pittsburg, Spring River and tributaries (Fig. 1).

The majority of the samples were collected within 10 days of the opening of the season in an effort to obtain fresh specimens. Internal parietal and peritoneal adipose tissues were used in the analysis since the pelts of these animals had been removed and external tissues may have been exposed to contaminants. Approximately 20g of tissue were collected from each animal. Samples were wrapped in aluminum foil and placed in labeled paper bags.

Four composite samples were prepared from specimens collected at each location: adult males, adult females, juvenile males, and juvenile females. Each composite consisted of tissues from five animals. Only one composite sample was prepared for the Great Bend location due to lack of obtainable specimens. The single Great Bend composite contained both adult males and adult females. Juvenile raccoons (<1 year old) were distinguished from adults by the presence of deciduous dentition or by the presence of canine teeth with an open apical root foramen.

Samples were processed at the Kansas Department of Health and Environment laboratories in Topeka, Kansas. Samples were prepared and extracted as per section VI of the Modification of Mills, Onley, Gather Method for the Determination of Multiple Organochlorine Pesticides and Metabolites in Human or Animal Adipose Tissue (EPA, 1980). Deviations from the procedure included the use of methylene chloride instead of petroleum ether as the extracting solvent and the use of 20 g of tissue instead of 5 g. Methylene chloride extracts of raccoon adipose tissue were "cleaned up" at the EPA laboratory in Kansas City using Gel Permeation Chromatography.

Final extracts were analyzed at Kansas Department of Health and Environment laboratories using electron capture gas chromatography. Extracts were scanned for an established routine list of chlorinated pesticides and PCB's (Table 1). During the scan, any other pesticides detected were also quantified. *p,p'* DDE, hexachlorobenzene, and heptachlor epoxide were found in a number of samples. Therefore, each sample was analyzed for these pesticides.

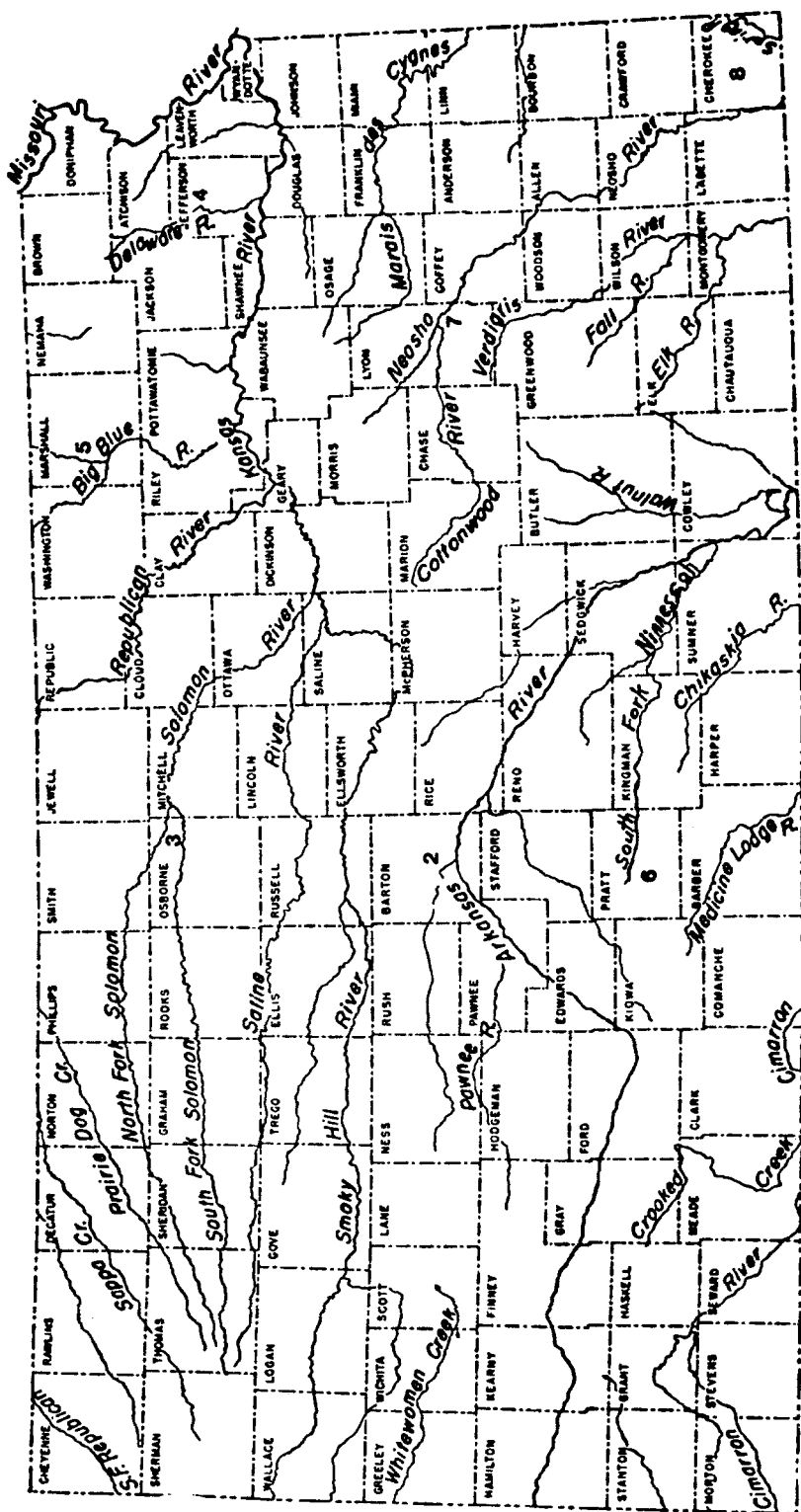


Figure 1. Sample collection points for survey of pesticide contaminants in raccoons (see text).

Table 1. Detection limits for analyzed pesticides.

Chemical	Detection Limit mg/kg)
Alachlor	0.250
Aldrin	0.025
Atrazine	1.200
Chlordane	0.250
Chlorthal dimethyl	0.050
o,p' DDT	0.100
p,p' DDT	0.100
Dieldrin	0.050
Metolachlor	0.250
P.C.B.s	0.500
Propachlor	0.250
Metribuzin	0.100
Endrin	0.100
Lindane	0.025
Methoxychlor	0.200
Toxaphene	2.000
Hexachlorobenzene*	0.010
Heptachlor Epoxide*	0.040
p,p' DDE*	0.040

\* Not on routine sample list but added to analysis for all samples after identification in some samples.

## RESULTS AND DISCUSSION

Only one sample contained any of the contaminants on the routine lists (Table 1). Chlordane was detected at 2.4 mg/kg in the adult male composite collected at Pratt. These specimens came from the area surrounding the South Fork of the Ninnescah River. The river originates about two miles west of Pratt, Kansas and derives its flow primarily from the large Big Bend Prairie Aquifer. The source of chlordane is unknown but may be due to improper disposal of the pesticide. No other municipality borders the river and agricultural uses have been banned. Chlordane levels in the Pratt raccoon sample were three times higher than the FDA action level for rendered fat which is 0.8 ppm. Chlordane has been found in fish tissue samples below major municipalities including the Arkansas river below Wichita (EPA, unpublished data). Surprisingly, chlordane was not found in the Ark City raccoon samples which were collected on the Arkansas River at a point below where contaminated fish tissue samples were collected. It may be possible that the Arkansas River is too large at that point to be extensively used as forage habitat by raccoons, thereby causing the raccoons to forage in more terrestrial environments associated with the river's riparian habitats.

p,p 'DDE was found in two composite samples, both adult males. These samples were collected at Ark City (Arkansas River) and Downs (tributaries of Waconda Reservoir). Contaminant levels were 0.055 mg/kg and 0.046 mg/kg, respectively.

Hexachlorobenzene and heptachlor epoxide were found in numerous samples indicating that they are widespread contaminants (Table 2 and 3). Seven of eight adult male composites contained heptachlor epoxide with levels ranging from 0.045 to 0.58 mg/kg. It is possible that one raccoon with levels five times that reported may have been responsible for the finding. Fifty-percent of the adult female composites also contained this contaminant while three juvenile male composites had detectable levels of heptachlor epoxide. No juvenile females were contaminated with this chemical at detectable levels. Oddly, the highest level of contamination of heptachlor epoxide was found in a composite of juvenile males (0.65 mg/kg).

Hexachlorobenzene was found in seventy-five percent of adult male composite samples, ranging from levels of 0.012 mg/kg to 0.44 mg/kg. Two samples of adult females exhibited detectable levels while only one sample each of juvenile males and females showed hexachlorobenzene contamination.

Hexachlorobenzene and heptachlor epoxide were also found in many fish tissue samples collected across Kansas from reservoir sites (KFGC, unpublished data). Traces of

Table 2. Levels of hexachlorobenzene (mg/kg) found in raccoon lipid samples by sex, age and location.

Location	Adults		Juveniles	
	Males	Females	Males	Females
Ark City	0.013*			-
Downs		0.016	0.018	-
Valley Falls	0.030	-	-	-
Blue Rapids	0.440	-	-	0.017
Pratt	0.012	-	-	-
Emporia	0.150	0.021	-	-
Pittsburg	-	-	-	-
Great Bend		0.015		

\*Composite of 5 samples.

Table 3. Levels of heptachlor epoxide (mg/kg) found in raccoon lipid samples by sex, age, and location.

Location	Adults		Juveniles	
	Males	Females	Males	Females
Ark City	0.045*	-	0.048	-
Downs	0.140	0.350		-
Valley Falls	0.580	0.083	-	-
Blue Rapids	0.048	0.063	-	-
Pratt	0.099	-	0.650	-
Emporia	0.130	0.370	0.043	-
Pittsburg	-	-	-	-
Great Bend		0.045		

\*Composite of 5 samples.

heptachlor epoxide were found in one pheasant sample from Kansas while hexachlorobenzene occurred in seventy-five percent of all pheasant composite samples analyzed (Layher, et al., 1985). Such widespread and consistent findings indicate that their occurrence comes from wide spread usage. Many of the drainages where these contaminants are found lack municipal or industrial sources, thus the contaminants probably originate from agricultural sources.

Analysis of variance did not detect differences ( $P>0.05$ ) in the pesticide levels of raccoons of the four age and sex categories or of raccoon composites from different locations. The widespread occurrence of heptachlor epoxide and hexachlorobenzene suggest that these chemicals should continue to be monitored in Kansas wildlife and the environment. Periodic re-evaluations of pesticide levels in raccoons will be useful in detecting long term trends in the accumulation of these pesticides.

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