

## LITERATURE CITED

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## OBSERVATIONS OF EFFECTS OF AN APPLICATION OF HEPTACHLOR OR DIELDRIN ON WILDLIFE \*

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Shortly after the inception of the imported fire ant eradication program, some concern developed among wildlife officials as to the possible effects of the program upon wildlife. An outgrowth of this concern was a cooperative study wherein the United States Department of Agriculture Plant Pest Control Division, the Alabama Department of Agriculture and Industry, and the Alabama Polytechnic Institute would work together. The Alabama Department of Conservation, the Bureau of Sport Fisheries and Wildlife (U. S. F. & W. S.) and the Wildlife Management Institute were brought into the study as partners in the Alabama Cooperative Wildlife Research Unit at Alabama Polytechnic Institute. The primary purpose of the cooperative study was to determine the immediate and long-term effects upon bobwhite quail (*Colinus virginianus*, Linnaeus) of the fire ant eradication treatments in use in early 1958, but some observations were also made on other species.

The original plan was to treat 20,000 to 40,000 acres in one block in Wilcox County, Alabama. This did not prove feasible, however, because landowners were reluctant to pay their one-third share of the cost of treatment, except on areas where the ant was a problem to them, and for other reasons. The study area finally agreed upon was located 4 miles northwest of Camden, Wilcox County, Alabama. It included the Lower Coastal Plain Substation of the A. P. I. Agricultural Experiment Station and two contiguous farms used as the test area, and a check area 2 miles away. A total of 4,700 acres in the area was divided as follows:

- 2,400 acres to be treated with heptachlor
- 1,200 acres to be treated with dieldrin
- 600 acres not to be treated and to be used as a check area
- 500 acres treated the year before by farmers and not a part of the experiment.

## PROCEDURES

*Description of study areas:* About one-third of the treated area was Alabama River flood plain which was poorly drained. Approximately 90 per cent of this bottomland was in good to excellent permanent pasture. The remainder was mostly in cultivation and temporary pasture. Bottomland soils were chiefly Ocklockonee Clay Loam and Leaf Clay Loam. The check area, which was river bottom, had similar soil, cover and game conditions.

The upland part, approximately two-thirds of the treated area, was mostly in mixed pine-hardwood forest. Suitable ridge tops had been cleared and were in cultivation, pasture or in various states of old field succession. Upland soils were Guin Sandy Loam and Wickham Silt Loam, both with adequate to excellent surface drainage.

Game conditions on the areas were average for the vicinity. Bobwhite quail, cottontail rabbits, mourning doves and wild turkeys were present in huntable

\* A contribution of the Alabama Cooperative Wildlife Research Unit, the Alabama Polytechnic Institute, the Alabama Department of Conservation, the Wildlife Management Institute and the U. S. Fish and Wildlife Service, Bureau of Sport Fisheries and Wildlife, cooperating.

numbers. Signs of predators and scavengers such as free-ranging dogs, foxes, raccoons and opossums were common.

*Application of the insecticide:* Application of the poison was by air at the rate of 2 pounds of the technical material per acre. The granular formulation used resulted in a minimum amount of dust which, in effect, applied the poison to the ground—not to the vegetation. This rate of application and formulation was recommended in A. P. I. Extension Circular 516 (Revised) which also included the following precautions concerning chlordane, heptachlor and dieldrin:

“All of these insecticides are toxic to bees, birds, fish, game, and most other species of animals including man. However, these insecticides cause no serious damage when applied to relatively small areas, such as open fields and pastures. To protect yourself, follow the manufacturer's instructions.”

Application of the poison began on March 17 and was completed by April 1, 1958. Rains and wind were frequent during this period, and prolonged the period of treatment considerably. In 4 out of the 5 times when applications were made no rain fell from 5 p. m. the day before application until 5 p. m. the day of application, but rain occurred within 3 days afterwards in each case. Soil moisture conditions varied from water-logged bottomland soils to well-drained upland soils.

Two planes were used—one for dieldrin and one for heptachlor. Treatment started at both ends of the contiguous areas and proceeded toward their common boundary.

The original agreement between the cooperating agencies called for a blanket treatment of the 3,600 acres. Immediately prior to treatment, this agreement was modified to exclude open water of a beaver swamp.

*Methods of study:* It had been hoped that detailed studies could be made on several species covering a wide variety of ecological type. Limitations of funds and personnel reduced the scope of the detailed study to that of the bobwhite quail and an ecological study of a beaver swamp. The study of the immediate effects of the treatment on quail included pre- and post-treatment censuses on the treated and check areas, search for dead, chemical analysis of dead recovered, and day by day observation of a declining covey.

Although no detailed studies of other wildlife were planned, observations incidental to the quail work shed some light on the broad effects of the insecticidal treatment. Some treated areas of favorable habitat were searched for dead specimens of all kinds before the entire area was treated. Later, in the post-treatment quail census, additional specimens were found. It was not possible to search systematically the entire area and generally, efforts were concentrated in the better habitat types. A sample of each species was saved for chemical analysis unless decomposition had progressed too far. Others were simply tagged to avoid duplication, and left for further observation. The process of application of the poison was observed carefully. Catch pans were used to sample the rate and uniformity of fall for comparison with the planned treatment and careful attention was given to the treatment of the beaver swamp.

## RESULTS

*Application of the poison:* A more detailed consideration is given elsewhere to the rate of application and distribution of the poison as indicated by our samples. Briefly, the samples were so variable that no conclusions could be drawn as to the overall application. The average sample was somewhat below the 2 pounds per acre rate for both insecticides.

*Observation of the treatment of the beaver swamp* revealed that the flow of granules ceased on each pass over the swamp, but that some poison fell in the water. Also, due to a shift in wind from one day to the next, a strip about 200 yards wide was missed—at least no poison was caught in pans placed in this strip.

*Effects on quail:* Thirteen coveys completely disappeared after treatment. Two surviving coveys were on the edge of the treated area and were found on the treated area only once each in 7 sightings. Coveys that disappeared included some ranging partly on untreated land.

Post-treatment census did not begin on any of the area until after the entire area was treated. Consequently, some of the area was not censused until 16 days after it was treated. The only evidence of the quail formerly present in these places was the remains of several dead.

In ranges poisoned near the end of the treatment, covey remnants were found and one of these was followed from day to day until all were gone and 5 of the original 10 birds were recovered dead. Analysis at Patuxent Research Refuge of these quail and others from both treated areas revealed amounts of poison in sufficient quantity to be the assumed cause of death in all but one specimen. These facts, combined with the excellent survival of quail and their presence as coveys after April 1 on the check area, indicated beyond reasonable doubt that the disappearance of quail on the treated area was due to the lethal effects of the poison. Contributing causes, if any, were insignificant.

*Effects on other wildlife:* Altogether, records were kept of 53 different kinds of vertebrates represented by over 187 specimens found dead on the treated areas prior to May 17, 1958 (see Table I). The first 100 recovered specimens were analyzed at Patuxent and lethal amounts of poison were found in all but 6 specimens. The specimens found probably represented a fair sample of those more easily found dead. The small number of mammals found as compared to birds is probably due to their secretive habits. The 2 snakes represent all the reptiles found early in the investigation, but amphibians and fish represent hardly more than a minimum sample of each kind. The fish in temporary waters and small tributary streams appeared to have been completely eradicated,

TABLE I  
SUMMARY OF DEAD FOUND TO MAY 17, 1958 ON TREATED AREAS

<i>Mammals:</i>		<i>Birds—Continued:</i>	
Swamp Rabbit	1	Chipping Sparrow	2
Cottontail	17	Field Sparrow	3
Red Fox	5	White-Throated Sparrow	3
Housecat	1	Song Sparrow	1
Cotton Rat	6	Unidentified Sparrow	8
White-Footed Mouse	1		
Unidentified Mouse	5	SUBTOTAL	114
Skunk	1	<i>Reptiles:</i>	
SUBTOTAL	36	Yellow-Bellied Water Snake	1
		DeKay's Snake	1
<i>Birds:</i>		SUBTOTAL	2
Lesser Scaup	1	<i>Amphibians:</i>	
Broad-Winged Hawk	1	Bullfrog	3
Red-Shouldered Hawk	1	Leopard Frog	6
Quail	21	Green Frog	3
Virginia Rail	1	Green Tree Frog	1
Wilson's Snipe	3	Unidentified Frog	8
Woodcock	1	SUBTOTAL	21
Mourning Dove	2	<i>Fish:</i>	
Barred Owl	1	Green Sunfish	1
Red-Headed Woodpecker	1	American Eel	1
Red-Bellied Woodpecker	1	Unidentified Fish	3
Blue Jay	1	Blue Gill	3
Crow	1	Green Sunfish	1
Meadow Lark	13	Black Bullhead	1
Red-Winged Blackbird	2	Stump Knocker	1
Hermit Thrush	3	Southeastern Creek Chub	1
Brown Thrasher	11	Sucker	1
Mockingbird	2	Bowfin	1
Carolina Wren	2	SUBTOTAL	14
Kentucky Warbler	1		
Cardinal	13		
Towhee	2		
Savannah Sparrow	7		
Vesper Sparrow	2		
Junco	3	GRAND TOTAL	187

although some amphibians survived. No abnormal mortality was noted on the check area.

Of considerable interest is the relative number of different classes of vertebrates found in different broad habitat types. Table II presents such an analysis for the specimens sent to Patuxent. In general it seems that the dead were found in habitats most suitable for each kind. The high percentage of the total number of birds found dead in pastures and woods borders is related to the large amount of time spent searching in these two types. Other pertinent factors were the bright colored species, such as meadow larks and cardinals, found in these habitats and the open cover.

By listing the species found in each habitat it was found that only 3 species were found in more than one habitat type. This minor overlap indicated clearly that the distribution of the dead was correlated with habitat.

In summary, heptachlor or dieldrin applied by air at the rate of 2 pounds per acre, or less, appeared to result in a total kill of quail in 13 coveys that ranged all or most of the time on treated land. Two other coveys, ranging mostly off the treated land, survived. A wide range of other vertebrate animals was killed. Distribution of the observed kill was correlated with habitat and perhaps also with time spent searching in a given habitat.

TABLE II  
NUMBER AND PERCENTAGE OF ANIMALS FOUND DEAD AT CAMDEN BY  
LAND-USE TYPES TO MAY 17, 1958

<i>Animal Class</i>	<i>Pasture</i>		<i>Old Field</i>		<i>Woods Border</i>		<i>Cultivated Field</i>		<i>Small Waters</i>		<i>Swamp</i>		<i>Total</i>	
	<i>No.</i>	<i>%</i>	<i>No.</i>	<i>%</i>	<i>No.</i>	<i>%</i>	<i>No.</i>	<i>%</i>	<i>No.</i>	<i>%</i>	<i>No.</i>	<i>%</i>	<i>No.</i>	<i>%</i>
Mammals	0	0	8	42.1	11	57.9	0	0	0	0	0	0	19	19
Birds	22	39.3	15	26.7	17	30.4	0	0	0	0	2	3.6	56	56
Reptiles	0	0	0	0	1	50.0	0	0	0	0	1	50.0	2	2
Amphibians	0	0	0	0	0	0	0	0	8	80.0	2	20.0	10	10
Fish	0	0	0	0	0	0	0	0	5	38.5	8	61.5	13	13
TOTALS	22	22	23	23	29	29	0	0	13	13	13	13	100	100

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