exposed to all their surroundings and responsive to them to a degree beyond our comprehension, in confirmation of which we need only point to the innumerable theories advanced by physicists in an effort to explain the ability of birds to find their way, theories that run all the way from terrestrial magnetism to specially sensitive membranes of the ear.

In the words of Lansborough Thompson, "One does not necessarily attach importance to the behavior of birds not wholly subject to natural conditions."

MADISON, WISC.

HIGHWAY CASUALTIES IN CENTRAL ILLINOIS DURING 1937

BY WILLIAM CHARLES STARRETT

Students of nature have long been aware of the disastrous rôle the automobile plays in destroying our wildlife; however, it has never been pointed out to what degree this destruction is carried throughout an entire year in a given area. Most of the literature on this subject is a summary of a trip across a number of states during one season. It is the purpose of the writer to show the amount of casualties through one year, 1937, in Central Illinois. No doubt the death rate due to automobiles fluctuates from one year to another, varying with the temperature, humidity, and precipitation (Dreyer, 1935). Also the rate will change due to animal cycles of abundance. According to Stoner (1936) the mortality varies among species in different localities. The writer was greatly impressed by this fact while making a tour through New York State and New England in 1933, by the great amount of skunks seen dead on the highways in comparison to Illinois. The following results may then be applied to Central Illinois, and used only as a comparison to other sections and regions of North America.

The focal point of this study was Peoria, Illinois, from which place 219 trips were taken for a total of 7,529 miles, averaging 34.56 miles per trip. The greatest distance from Peoria was eighty miles. Mileage and observations were kept only on well traveled highways in the country. Domesticated animals, such as poultry, dogs, and cats were omitted, confining the survey to wildlife only.

Central Illinois is located in the heart of the agricultural belt of the Middle West; consequently, most of the land is tilled, the chief crops being corn, wheat, and oats. This view is occasionally broken by an oak-hickory grove.

The mortality seems to be divided into five sections or seasons due to temperature, activity, and the appearance of certain species. The survey began the first of January, which was during the winter season. This season lasted through March 21, and began again November 15, lasting for the remainder of the year. The casualties of the two winter seasons were almost equal; .038 vertebrates for the first, and .040 for the second. The pre-spring season was inaugurated by the appearance of the woodchuck, which ended with the appearance of snakes, April 13. The spring season ended June 20, based on the great increase of animal activity along the highways. The summer season terminated August 31, with the increase of snake mortality. The pre-fall season lasted until October 12, with the decline of great animal activity. The fall season came to a close November 15, with the beginning of cold weather and snow.

For a complete summary of casualties see Tables I and II.

Mammals represented 24 per cent of the vertebrates killed, of which the cottontail rabbit composed 17 per cent and 70 per cent of the mammals. The rabbit, of all the vertebrates, is the only one whose mortality varies little through the seasons. If the results were plotted on a graph, the rabbit would appear in almost a straight line; whereas the other vertebrates would rise and fall in relation to seasons.

TABLE I. Vertebrate Casualties in Central Illinois, 1937.

NAME OF VERTEBRATE MAMMALS	WINTER (2067 miles)	PRE-SPRING (581 miles)	SPRING (1652 miles)	SUMMER (1296 miles)	PRE-FALL (868 miles)	FALL (418 miles)	WINTER (647 miles)	TOTAL FOR ENTIRE YEAR
Opossum	0	0	2	0	0	2	0	4
Common Mole	0	0	0	0	0	1	0	1
Common Skunk	0	0	0	1	1	1	0	3
Woodchuck	0	1	3	2	0	0	0	6
Striped Gopher	0	0	5	13	3	1	0	22
Gray Gopher	0	0	2	0	1	0	0	3
Fox Squirrel	0	0	3	2	5	0	0	10
Eastern Meadow Mouse	0	0	0	4	2	2	0	8
Norway Rat	0	0	0	2	2	1	1	6
Cottontail Rabbit	43	15	31	20	18	11	17	155
Unidentified	0	0	0	1	0	0	0	1
No. Mammals								219

BIRDS								
Hooded Merganser	0	1	0	0	0	0	0	1
American Rough-legged Hawk	1	0	0	0	0	0	0	1
Eastern Sparrow Hawk	1	0	0	0	1	0	1	3
Eastern Bob-white	1	0	0	1	0	0	0	2
Ring-necked Pheasant	0	0	1	0	0	0	0	1
Spotted Sandpiper	0	0	0	1	0	0	0	1
Eastern Mourning Dove	0	0	0	1	0	0	0	1
Northern Barred Owl	0	0	0	1	0	0	0	1
Northern Flicker	0	0	1	2	0	0	0	3
Red-headed Woodpecker	2	0	3	15	4	1	0	25
Yellow-bellied Sapsucker	0	0	0	0	1	0	0	1
Northern Downy Woodpecker	0	0	1	0	0	0	0	1
Eastern Kingbird	0	0	1	0	0	0	0	1
Northern Crested Flycatcher	0	0	0	1	0	0	0	1
Eastern Phoebe	0	0	0	1	0	0	0	1
Prairie Horned Lark	1	0	0	1	0	0	0	2
Barn Swallow	0	0	0	4	2	0	0	6
Rough-winged Swallow	0	0	0	1	4	0	0	5
Eastern Crow	1	0	0	0	0	1	1	3
Catbird	0	0	0	1	0	0	0	1
Brown Thrasher	0	0	2	3	0	0	0	5
Eastern Robin	0	1	11	8	3	0	0	23
Migrant Shrike	0	0	1	0	0	0	0	1
Starling	0	1	2	5	5	2	0	15
English Sparrow	28	2	53	244	113	30	5	475
Eastern Meadowlark	0	0	3	5	0	1	0	9
Eastern Red-winged Blackbird	0	0	0	2	0	0	0	2
Rusty Blackbird	0	0	0	0	1	0	0	1
Bronzed Grackle	0	0	0	2	1	0	0	3
Dickcissel	0	0	1	3	0	0	0	4
Towhee	0	0	0	1	0	0	0	1
Eastern Field Sparrow	0	0	0	1	0	0	0	1
Unidentified	0	0	0	5	0	0	1	6
No. Birds								607
REPTILES								
Bull Snake	0	0	17	4	13	1	0	35
Garter Snake	0	0	1	3	8	1	0	13
Coluber sp.	0	0	1	2	9	0	0	12
Chrysemys sp.	0	0	0	2	1	0	0	3
Chelydra sp.	0	0	1	0	0	0	0	1
No. Reptiles								64
AMPHIBIANS								
Rana sp.	0	0	0	1	0	0	0	1
Bufo sp.	0	0	0	1	0	0	0	1
No. Amphibians								2
Total Numbers	78	21	146	367	198	56	26	892

Birds were the most frequent dead vertebrates, composing 68 per cent of the fatalities. The English Sparrow represented 53 per cent of all the vertebrates, and 78 per cent of the birds. Eighty-eight per cent of the bird mortality occurred during the warmer seasons (April 13 through October 12). The Red-headed Woodpecker made up 2.8 per cent of all mortality and 4 per cent of the birds. In central Illinois the Red-headed Woodpecker is a permanent resident; however

only two were found killed by cars during the winter months. This is due to their habit of being a roadside bird only through the warmer months, and spending the remainder of the year in the white oak-hickory woods.

Reptile mortality was highest during the spring and pre-fall seasons. The logical explanation for this seems to be that the highways were the warmest places the snakes could find. The reptiles represented 7 per cent of all vertebrate fatalities, out of which the bull snake made up 3.9 per cent and 58 per cent of the snakes. Turtle casualties would have been found higher had more trips been taken in the region of lakes, rivers, and sand dunes.

A total of 174 game animals were noted, this group made up 19 per cent of the mortality. The rabbit represented 89 per cent of the game animals. Beneficial and game animals combined were 43 per cent of all mortality. The remaining 57 per cent were non-beneficial animals, chiefly English Sparrows.

TABLE II. Amount of Mortality per Mile.

	Winter	Pre-Spring	Spring	Summer	Pre-Fall	Fall	Winter	Average for Year
All vertebrates	.038	.036	.088	.283	.228	.134	.040	.118
Mammals	.021	.028	.028	.035	.037	.045	.028	.029
Cottontail	.021	.026	.019	.015	.021	.026	.026	.021
Birds	.016	.009	.048	.238	.156	.084	.011	.080
Reptiles	.000	.000	.012	.008	.036	.005	.000	.009
Amphibia	.000	.000	.000	.002	.000	.000	.000	.0002

Stoner (1936) tabulated results from several surveys on highway casualties over the eastern part of North America during the warmer months, and found an average of .153 dead vertebrates per mile, including domesticated animals. An average of .186 was found by the writer in central Illinois over the same period and included only wildlife. Excluding domesticated animals from Stoner's (1936) trip across Illinois, .207 vertebrates per mile were noted; .228 per mile was found by the present writer in 1937 during the same season.

The average over the entire year was .118 dead vertebrates per mile or a casualty every 8.47 miles.

From the writer's experience the killing of birds by an automobile seems to be unavoidable in most instances; however, the mortality in mammals and reptiles could be lowered if drivers were educated to avoid them.

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PEORIA, ILLINOIS.