POPULATIONS OF SMALL MAMMALS ON RAILROAD RIGHT-OF-WAY IN PRAIRIE OF CENTRAL ILLINOIS

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ABSTRACT.—Snap-trapping (approximately 1700 trap nights, 34 lines) was performed from July 1964-July 1966, in tall grass prairie of railroad rights-of-way in central Illinois. The habitats are described generally, in regard to climate, soil, and vegetation. Small mammals (326) representing six species (*Mus musculus, Blarina brevicauda, Microtus ochrogaster, Peromyscus maniculatus, P. leucopus*, and one specimen of *Spermophilus tridecemlineatus*) were trapped. Other mammals observed were *S. franklinii, Marmota monax, Sylvilagus floridanus, Didelphis marsupialis, Mephitis mephitis*, and one *Mustela erminea*. *P. leucopus*, the most abundant mammal, was taken in all habitats of the study area. Sex and age ratios for *P. leucopus* were obtained. Its mean number of embryos was 4.28 ± 0.95 (2-6, N = 31). Its breeding subsides in winter and summer. Males of juveniles or adults generally exceed in number females of comparable age. Females nearing term of pregnancy are significantly less abundant than those with tiny embryos. Reproductive data on other small mammals are presented. *P. maniculatus* was usually associated with horsetails. *Mus musculus* was seldom taken in tall grass prairie, but was locally abundant on two occasions.

The "flat lands" of central Illinois have been disturbed drastically by agricultural practices. The deep, rich soil and level terrain of the "prairie peninsula" (Transeau, 1905) once supported deciduous red oak-maple-basswood-elm forest and tall grass prairie (Shelford, 1963; Gleason, 1912; Vestal, 1913; Sperry, 1935; Vestal and Heermans, 1945). Along the rights-of-way of several railroads in this area there is relatively undisturbed tall grass prairie, maintained by drainage, occasional clearing of brush, and burning. Hardly a "wilderness," this habitat seldom has been investigated systematically, even though it now provides the best source of information available on the former prairie in this intensively cultivated area. Although my departure from central Illinois precluded much of the intended investigation of this habitat, it is my purpose to record my findings especially in regard to the small mammals, so that this information may be available for future work.

METHODS

Small mammals were sampled by snap-trapping for 18 successive months, except September, December, and January. One preliminary trap line was set in July, 1964, and the remainder (33 lines) from February 22, 1965, to July 30, 1966. Although 50 traps were used in each line, in some warmer months large ground squirrels, grasshoppers, wind-blown leaves, and rain sprung some traps, and a vandal cut the treadle-locking wires from 20 traps on the next to the last line set out. With rolled oats used as bait, traps were placed at 10-yard intervals, usually in a straight line about 490 yards in length.

Observations on vegetation, road kills, and live animals provided some information, such as on the emergence of ground squirrels from hibernation. However, a systematic natural history

was not attempted. Home range was not determined.

The *Peromyscus* were assigned to age categories, defined as "adults" and "subadults" if characterized by reddish or dull brownish (fresh) dorsal pelages, respectively, and as "juveniles" if gray. Size and reproductive activity were utilized also in determining maturity. Immature *P. leucopus* fall in the range of variation for *P. maniculatus*. Owing to the far greater abundance of *leucopus* all juvenile *Peromyscus* were assigned to that species. The key characters listed by Hoffmeister and Mohr (1957) usually identify adults of these species. One valuable new diagnostic character utilized is the shape of the tail. In subadult *leucopus* it is short, but more attenuate distally than in *maniculatus*. All females were dissected in order to determine pregnancies. The crown-rump length was measured of the largest embryo in each pregnant mouse.

Study Area

Railroad rights-of-way were investigated in central Illinois, along a west-east line three miles east of Monticello through Champaign-Urbana to five miles east of St. Joseph—approximately 40 miles, including some areas (e. g., towns) not studied because of drastic disturbance. The railways were of the Illinois Central Railroad, west of Champaign, and the Norfolk and Western Railway, east of Urbana. The habitats along the rights-of-way varied markedly in width. In many places the boundaries of the habitat were delimited sharply by plowed fields or mowed roadsides.

Some Physical Factors: Climatic data obtained during the study are summarized in Table I. Graphs (not published) based on this table reveal slight differences between the two winters, in regard to temperature. December and January in 1964-1965 were cooler and warmer, respectively, than these months were in 1965-1966. Precipitation was low in the fall of 1964, compared to that of 1965. It was very low in October-January of 1965-1966, and there was little snow cover then. The total snowfall for November-March, 1964-1965, was significantly greater than for the same period in 1965-1966. The relative humidity changed little throughout the study.

The soil is sandy loam, blackish when moist, gray when dry, occasionally brownish. The roadbed of gravel and cinders supports some vegetation on the slopes, and contains burrows of several mammals (e.g., rabbit, ground squirrel, woodchuck) and some insects (e.g., ants). The water table is rather high, especially in a rainy spring. Extensive burning of the habitat was observed in May, 1966.

Vegetation: The vegetation was fairly homogeneous for many miles along the railroads. Vegetation types observed were (1) brush communities of blackberry (*Rubus*), wild plum and cherry (*Prunus*), and sumac (*Rhus*); (2) herbaceous communities dominated by tall grasses or forbs, of which goldenrod (*Solidago*) and milkweed (*Asclepias*) were conspicuous; (3) wetlands supporting cattails (*Typha*), willow (*Salix*), and sedges (*Carex*); and (4) dense stands of horsetails (*Equisetum*) intermixed with blackberry on dry sandy roadbed or bordering marshes. In the spring, annual plants push up through the broken down vegetation of the previous year, and may attain heights of six feet or more by autumn. Some introduced (or weedy) species were present such as dandelion (*Taraxacum*), red clover (*Trifolium*), alfalfa (*Medicago*), and mullein (*Verbascum*).

Mammal Populations

Carnivores were not common. Skunks (*Mephitis mephitis*) were found occasionally, dead on the highway adjacent to the railroad right-of-way. Domestic cats (*Felis catus*) were seen occasionally, in day or night. A lactating ermine (*Mustela erminea*) was found dead on the road four miles west of Bondville, adjacent to the study habitat. (This record is marginal for the known geographic range of the species.) Chicken bones were at the entrance of a den (fox?), but no hairs or scats were observed. The badger (*Taxidea taxus*) has been taken at St. Joseph, but none was seen in the area.

Other probable predators were *Spermophilus franklinii* and *Blarina brevicauda*. Both are well-known

TABLE 1.—General climatic data in the period July, 1964-July, 1966, from central Illinois.

	Temperature (°F)								Precipitation (inches)	Total Snowfall (inches)
	Means			Extremes			Relative Humidity			
	Max.	Min.	Mean	Max.	Min.	Max.	Min.	Mean		
July 1964.....	85.6	65.8	75.7	94	52	100	29	75.0	2.41	0
Aug. 1964.....	84.5	60.9	72.7	101	51	100	31	71.0	2.59	0
Sept. 1964.....	78.3	55.8	67.1	93	41	99	19	68.0	2.18	0
Oct. 1964.....	65.4	40.7	53.1	82	30	98	20	61.0	0.16	0
Nov. 1964.....	55.4	35.1	45.3	77	6	98	21	67.0	3.42	6.9
Dec. 1964.....	35.5	22.9	29.2	53	2	96	48	84.0	1.79	3.6
Jan. 1965.....	36.7	18.5	27.6	62	−5	95	33	75.0	4.13	8.3
Feb. 1965.....	39.2	20.5	29.9	60	−6	.....	.....	.....	1.46	5.7
March 1965.....	38.6	24.0	31.3	59	10	93	33	69.0	2.50	10.6
April 1965.....	62.6	43.2	52.9	84	30	100	34	73.0	5.64	0
May 1965.....	79.1	56.9	68.0	89	39	100	29	71.5	3.66	0
June 1965.....	81.5	60.7	71.1	91	52	98	28	70.5	3.05	0
July 1965.....	83.4	63.5	73.5	94	53	100	20	73.5	5.12	0
Aug. 1965.....	81.1	61.5	71.3	92	46	100	35	74.8	6.89	0
Sept. 1965.....	76.6	57.1	66.9	89	39	100	33	77.0	5.91	0
Oct. 1965.....	65.0	44.8	54.9	82	28	97	23	66.0	1.96	0
Nov. 1965.....	53.6	35.1	44.4	71	17	99	27	68.0	1.24	0
Dec. 1965.....	44.3	30.6	37.5	63	15	97	35	74.0	2.88	1.3
Jan. 1966.....	29.7	14.0	21.9	55	−12	93	27	66.0	0.40	0.5
Feb. 1966.....	37.5	21.3	29.4	58	2	94	22	67.5	2.07	6.6
March 1966.....	51.0	32.2	41.6	73	16	97	22	66.0	1.91	3.1
April 1966.....	58.3	40.1	49.2	76	29	100	24	67.0	4.64	0.1
April 1966.....	58.3	40.1	49.2	76	29	100	24	67.0	4.64	0.1
May 1966.....	68.5	46.4	57.2	87	30	100	21	70.5	2.99	0
June 1966.....	84.1	60.3	72.2	95	49	100	45	77.0	3.02	0
July 1966.....	90.2	67.1	78.7	101	56	100	35	79.5	1.34	0

omnivores. Franklin's ground squirrels were observed from May to July. Five adults were seen along one trapline on May 4, 1966, in prairie at Mayview. Others were seen nearby, so that a "colony" apparently was established. Dens and runways were abundant in the tall grass. In 1964 and 1965, this ground squirrel was not seen in late summer or fall. On May 4, 1966, one was seen eating a road-killed pheasant.

Two opossums (*Didelphis marsupialis*) were found dead on the road at Mayview prairie. Two large herbivores observed were the woodchuck (*Marmota monax*), and the cottontail rabbit (*Sylvilagus floridanus*). A juvenile woodchuck was observed June 4-5, 1966, near Mayview, Illinois. Only two adults were seen in this study, both in the morning, in May, 1966.

A thirteen-lined ground squirrel (*Spermophilus tridecemlineatus*) was caught in the area, and the species was fairly abundant locally along adjacent roadsides. However, its habitat was short (mowed) grass, and it was rarely observed in the

tall grasses of the study habitat. The one specimen obtained was an adult male taken July 29, 1965, one mile north of Allerton Park, Monticello. The small testes had apparently regressed in size. Thirteen-lined ground squirrels emerged about April 4, 1965, and March 26, 1966, at nearby Lake of the Woods (Mahomet, Illinois) where the species is abundant. In 1965, two were first seen on April 7 on short grass roadside near Mayview prairie.

Occasionally, fox squirrels (*Sciurus niger*) were seen between Urbana and St. Joseph (only gray squirrels were seen in Champaign-Urbana). A pregnant fox squirrel was found dead on the road April 7, 1965. It contained three embryos, 26 mm. in crown-rump length.

The small mammals trapped were the white-footed mouse, *Peromyscus leucopus*; the deer mouse, *P. maniculatus*; the feral house mouse, *Mus musculus*; the short-tailed shrew, *Blarina brevicauda*; and the prairie vole, *Microtus ochrogaster*. The white-footed mouse, also abundant in nearby woodlands, was the most abundant species, slightly exceeding 70 per cent of the small mammals trapped.

The age and sex composition of the monthly samples of *P. leucopus* are shown in Table II. Adults and sub-

TABLE 2.—Reproductive data for *Peromyscus leucopus* from mammals caught in 27 traplines (45-50 traps each). September, December, and January data are not available.

	Feb.	March	April	May	June	July	Aug.	Oct.	Nov.
No. and percent pregnant									
1965	0 0%	14 45%	6 67%	5 100%	1 50%	0 0%	2 67%	1 25%	0 0%
1966	0 0%	.....	.....	.....	2 100%	0 0%	.....	.....	.....
No. formerly pregnant (lactating)									
1965	0	0	0	1	1	1	1	1	1
1966	0	0	1	0	4	.....	.....	.....	.....
Some males with swollen scrota									
1965-1966	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
Mean litter size									
1965-1966	.....	4.14	4.86	4.60	3.7	.....	4.00	4.00	.....
Sex ratio (adults and subadults) male:female									
1965	5:3	33:30	31:10	4:6	5:4	10:4	6:3	10:8	0:4
1966	9:4	.....	0:1	.....	3:7	3:1	.....	.....	.....
Fraction Juveniles									
1965	1/9	0/63	9/47	6/16	2/11	0/14	1/10	7/25	1/5
1966	0/13	.....	.....	5/5 (after fire)	2/12	0/4	.....	.....	.....

adults usually numbered more than the juveniles, especially in winter and summer, but less so in spring and fall. Assuming an approximately even sex ratio at birth (Svendson, 1964; and others), the ratio of males to females increases significantly (0.05 level) in juveniles (21:9), and is significantly greater (0.02 level) in adults and subadults (119:85).

Reproductive data are summarized in Table II. There is little breeding in late fall and winter. Another pause in breeding activity occurs in summer, as reported for white-footed mice of Michigan woodland (Burt, 1940). Embryo counts averaged 4.28 (2-6; N, 31), with mode of four and standard deviation of the mean of 0.95. From this, the population range can be predicted as 1-7, which is in agreement with the data of Burt (1940), Svendson (1964), and others. There is no statistical evidence for change in litter size through the year.

Thirty-nine embryos of nine pregnant *P. leucopus* were distributed randomly in either the left or right cornu of the uterus. The number of embryos for the left was 20, right 19. The modal distribution was two on each side, closely approached by two on one side and three on the other.

In 31 pregnancies, most females of *P. leucopus* had small embryos.

Classes	*Pregnancies*	*Embryos*
1-4 mm.	11	45
5-8 mm.	6	30
9-12 mm.	7	32
13-16 mm.	2	9
17-20 mm.	5	18

The sum of the pregnancies in classes one and two (17) is significantly greater (0.05 level) than that of four and five (7). Birth may have lowered the frequencies somewhat of observed pregnancies in the late development class(es). However, data of Svendson (1964) indicate that at birth foetuses are longer than 20 mm., even if his "body length" exceeds crown-rump length. The evidence indicates that mice in early pregnancy are more susceptible to trapping than other pregnant mice. If the frequencies for crown-rump length are all increased to 11 (the frequency of the largest class and the lowest crown-rump length), then the number of pregnant females would be increased by 24, and the ratio of adult and subadult males to females would become 119:109. This hypothetical ratio is not significantly different from a 1:1 ratio at the 0.05 level. However, the significant preponderance of juvenile males over juvenile females (see above) indicates a skewed sex ratio prior to the age of breeding, in this habitat. Susceptibility to trapping of females in early pregnancy needs further investigation.

P. leucopus was taken in abundance in all habitats of the study area. Although it is often said that peak populations of rodents occur in autumn, and that they are low in winter, I did not find this true (Table II).

Twenty-five *P. maniculatus* were taken in this study, usually in horsetails. Three were taken ¼ mile from them in May, 1966, immediately subsequent to burning of the dead prairie grasses. The burning, incidentally, revealed surprising numbers of

mouse runways among the charred grass roots and stems and on the bare ground. Females of several species were more common then than males, and the juveniles (*Peromyscus* sp.) were more common than adults the month following the burning (but the data are scanty). The ratio of males to females for *P. maniculatus* was 10:15, not significantly different ($P<0.5$). The deer mouse was taken March-June, 1965, and February-May, 1966. Two embryo counts of three and five were observed in June and February, respectively. Three of three females were lactating on May 4, 1966; they contained no embryos.

Only nine *Microtus ochrogaster* were taken in this study. They were usually juvenile. Two adults, neither trapped although two traps were located less than three feet away, had a nest of dried grasses under a large piece of pressed wood (February, 1966). In the nest were 13 pits of wild plum, all of which had been opened by gnawing, by the *Microtus*, on one flat side. A runway led about 2½ feet from the nest (about 8 inches from the board) to a hole, at the entrance of which was a gnawed, partially exposed root. The nest was abandoned by March.

Nineteen *Blarina brevicauda* were caught; the catches were small (13) and distributed throughout the year. A female taken April 2, 1966, had five embryos, 6 mm. in crown-rump length. A small (subadult) specimen was taken October 5, 1965.

Thirty-one feral *Mus musculus* were taken, mostly adults. The ratio of males to females was observed as 16:11, the numbers not significantly different. House mice were taken in winter and spring of 1965 and not taken thereafter until October and February of 1965-1966. Thus, in the grassland feral house mice were locally abundant at certain times for reasons unknown. On February 22, 1965, two were pregnant (6,5 embryos).

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