ECOLOGY OF NORWAY RATS, *RATTUS NORVEGICUS*, ON A DESERTED FARM IN WESTERN OKLAHOMA

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The Norway rat population inhabiting a deserted farm in western Oklahoma was studied for a year. Live trapping techniques were used. Seasonal dynamics, interspecific reactions with other small mammals, and population structure were examined. Norway rats (*Rattus norvegicus*), hispid cotton rats (*Sigmodon hispidus*), eastern woodrats (*Neotoma floridana*), and six other species of small mammals were captured. The greatest number of Norway rats trapped was in late summer and the smallest number trapped was late in February.

In western Oklahoma many farm homesteads have been abandoned as the residents typically move to urban areas and commute to continue their farming operations. House and out-buildings are generally used for storage of grains and other products. The absence of or greatly reduced human activity during most of the day and increased availability of food produces a potentially favorable habitat for most rodent pests. This study attempted to evaluate the rat population on one such farm for a year in order that effective control measures might be developed.

Rats and other rodent species have presented pest problems to man for centuries and much research has been directed toward the problem. The ecology and sociology of the Norway rat, *Rattus norvegicus*, was extensively studied by Calhoun (1) in a Baltimore, Maryland "row house" residential area and Storer (2) examined the populations of island dwelling species. Extensive efforts have been made to characterize rat populations (3) and to evaluate the dynamics of a population that has been decimated (4). However, rats continue to present problems and in the arid, rural areas of southwestern United States little is known of rodent pest species and their biology.

In this study a vacated farm was selected and the existing population of Norway rats, *Rattus norvegicus*, was examined for ten months.

METHODS

The chosen farm was located in Custer County, five miles south and two miles east of Weatherford, Oklahoma. The residential portion of the farm occupied approximately five acres and provided an excellent habitat for rats in the form of low scrubs and trees, a dense undergrowth of herbaceous plants, numerous piles of rubbage, and several uninhabited buildings. A large two-story house, large garage, concrete block chicken house, large grainary, barn, and well house were located on the study area. Grain was stored in the garage, as well as the grainary, and hay was stored in the barn.

During the study, 85 live traps (5 x 5 x 16 in., wire mesh, Tomahawk Company) were positioned, roughly in a checkerboard pattern, in suitable locations for maximum trap efficiency of small mammals. Special efforts were made to cover migratory routes on the periphery of the study area, as well as heavily used areas (*e.g.*, runs, entry ways to buildings, nesting areas, etc.).

Each trap was numbered. A chart was drawn (and mimeographed) to show the location of each trap and to record each day's catch. Captured animals were marked and released immediately. Rats were earmarked individually for identification and other species were sprayed with picric acid in predesigned patterns in order that they could be easily recognized. The maximum and minimum air temperature, precipitation, and climatic conditions were observed each day and these data were compared to the trapping success.

Traps were baited with a mixture of rolled oats, honey, and peanut butter. This mixture was kept dry enough to allow it to be rolled into small balls, which were

pressed on the back portion of the trap treadle.

RESULTS

During the ten month study, most of the 85 traps were set for 225 days (a total of 18,700 trap days). Traps were idle only for one extended period, five days during January, but traps were often damaged and had to be replaced, a chore which often took from one to two days. Nine species of mammals were trapped during the study (Table 1); striped skunks (*Mephitis mephitis*) and Norway rats (*Rattus norvegicus*) were the most numerous. Since the study was directed toward rat species, the traps were not designed for smaller species, and although several smaller species were trapped, it was impossible to evaluate these species accurately as individuals often escaped. The highest number of captures occurred in fall and early winter.

In Table 2 trapping success is shown for two-week periods during the height of the capture season, from 25 September to 23 January. Trap conditions, bait conditions, and captures are compared to maximum and minimum air temperatures for the same period. The decline in capture

TABLE 1. *Species trapped during study (individuals per month)*

	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	April	May	June	Total
Eastern cottontail (*Sylvilagus floridanus*)	5	4	3	1	1	2	1	1	1	2	21
Eastern woodrat (*Neotoma floridana*)	15	9	3	2	2	2	1	2	2	1	39
Hispid cotton rat (*Sigmodon hispidus*)	7	5	0	1	0	1	0	0	1	1	16
House mouse (*Mus musculus*)	9	7	2	8	2	3	2	3	4	3	43
Norway rat (*Rattus norvegicus*)	19	7	8	7	5	3	4	11	15	18	97
Opossum (*Didelphis marsupialis*)	3	2	0	1	0	0	0	1	0	1	8
Pocket mouse (*Perognathus hispidus*)	1	0	0	0	0	0	0	0	1	0	2
Striped skunk (*Mephitis mephitis*)	11	8	10	14	4	11	5	1	2	1	67
Woodland deer mouse (*Peromyscus leucopus*)	5	4	2	8	1	1	1	1	2	1	26
TOTAL	75	46	28	42	15	23	14	20	28	28	319

TABLE 2. *Record of trapping during fall portion of the study (figures are for all species)*

	Traps tripped	Bait taken	Tripped and bait taken	Undisturbed traps	Captures	Temperature Max.	Temperature Min.
(1) 24 Sept.-8 Oct.							
Total	57	399	357	275	63		
Mean/day	4.1	28.5	25.5	19.6	4.4	79.2	43.0
(2) 9 Oct.-24 Oct.							
Total	64	468	399	216	22		
Mean/day	4.6	33.4	28.5	15.4	1.6	75.1	40.3
(3) 25 Oct.-8 Nov.							
Total	30	627	269	245	13		
Mean/day	2.1	44.8	19.2	17.5	0.9	58.4	33.1
(4) 9 Nov.-23 Nov.							
Total	35	560	158	402	16		
Mean/day	2.5	40.0	11.3	28.7	1.1	50.9	30.5
(5) 25 Nov.-8 Dec.							
Total	15	810	141	179	24		
Mean/day	1.1	57.9	10.1	12.8	1.7	61.3	37.1
(6) 9 Dec.-22 Dec.							
Total	24	796	119	221	18		
Mean/day	1.7	56.9	8.5	15.8	1.3	48.6	28.4
(7) 24 Dec.-7 Jan.							
Total	62	789	178	149	6		
Mean/day	4.4	56.4	12.7	10.6	0.4	41.0	19.7
(8) 8 Jan.-23 Jan.							
Total	22	580	340	23	6		
Mean/day	1.8	48.3	28.3	1.9	0.4	46.4	18.5

success appeared to be directly related to decreasing temperature and was independent of precipitation. By 23 January an average of 0.4 captures were made per day, whereas 4.4 captures per day were recorded for the period 25 September to 8 October.

Marked male Norway rats were captured in traps as far as 112 yards (average 98.4 yards) removed from each other, an indication of their home range. The ranges of female rats were much smaller with the greatest being 85 yards (average 69.3 yards) for one individual. The home range size did not appear to fluctuate seasonally, but rats migrated to fields in the spring and to buildings in the fall. One female was captured on four successive nights in four different traps on October 4, 5, 6, and 7. She was not seen again until April 26 when she was captured in still another trap and was not caught again during the study. The number of Norway rats captured per day fluctuated markedly during the year. The highest number trapped was during the summer (average 2.3 per day August 15-31) and the lowest number trapped was in the winter (average 0.2 per day February 15-28).

Striped skunks moved about much more and even migrated from one farm to another. One male skunk was caught nine times during the study and he ranged over the entire study area. During December the skunks aggregated for breeding and on one occasion three males were seen trying to mount one female. In the foreplay involved with mating, all her hair was pulled off except tufts on her head, tail, belly and four legs.

Eastern woodrats (*Neotoma floridana*), occupied smaller ranges than did Norway rats. Male woodrats were observed to move as far as 53 yards (average 42.2 yards) and females only 41 yards (average 36.3 yards).

The mammals observed in this study tended to migrate into the wheat fields that surrounded the residential part of the farm soon after the wheat was planted in the fall. When cold weather came and the excess wheat and insects were gone, the animals moved back to the buildings. In spring they migrated again when food and cover became available. Another migration back to the buildings occurred at harvest time in early summer.

The trapping success was greatly affected by small mammals, birds, and insects. Bait was often gone and traps were not tripped. Birds perched on the cage bars to eat the bait. Traps were often tripped by small mammals that stole the bait and escaped through the bars of the traps. Sherman traps were set near the Tomahawk traps to evaluate the small animal population involved and house mice, field mice, and harvest mice were captured. Many predators, such as hawks, owls, bobcats, domestic cats, and snakes, were sighted on the farm during the study.

DISCUSSION

The Norway rat population in this study was largest in September; its size decreased to a low in February and March, and then began to increase. The Eastern woodrat population was approximately the same in size as that of the Norway rat in the fall; it also decreased in the winter, but did not increase in the summer. It is possible that our presence had a greater effect on the woodrats than on the Norway rats. The striped skunk population was approximately the same during the fall and winter, but decreased in number in spring, a change which appeared to be due to migration. Trapping techniques were unchanged during the study and adult animals may have become "trap-wise," accustomed to the bait, frightened away by the checking of the traps, or affected by the presence of humans or other factors which would introduce experimental errors. However, data such as the increase in Norway rats captured in May and June, including marked animals first caught in the fall, minimize these factors.

The relationship of season to peak and low point of the population number observed in this study agrees with the findings of Calhoun (1), but the home range sizes for male and female Norway rats were larger than previously reported. Calhoun's experiments were conducted in a heavily inhabited residential area in Baltimore, Maryland where ample food and shelter were readily available. Survival under the extreme environmental conditions in rural southwestern Oklahoma offers a formidable problem for the Norway rat and his success depends upon his seasonal adaptability. Finding water and cover are most likely his biggest problems.

During the winter of this study, an outbreak of rabies in skunks was reported in the north central portion of Oklahoma. Special efforts were made to examine all skunks captured in this study; none of the animals had any symptoms of rabies. During the breeding season several females with large amounts of body hair missing were caught; breeding aggregations of four to five animals were common. It is possible that these physical conditions could be mistaken for signs of rabies. After the breeding season, few skunks were found around the farms; presumably they had migrated to fields and pastures. Several individual skunks were followed during the study and it was learned that they commonly move from one farm to adjacent farms in regular patterns.

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REFERENCES

1. J. B. CALHOUN, *The Ecology and Sociology of the Norway Rat*, U. S. Dept. of Health, Education and Welfare, Bethesda, Maryland, 1962.
2. T. I. STORER, *Pacific Island Rat Ecology*, Bernice P. Bishop Museum Bulletin No. 225, Honolulu, Hawaii 1962.
3. D. E. DAVIS, Quart. Rev. Biol. 28: 373-401 (1953).
4. J. T. EMLEN, A. W. STOKES, and G. P. WINSOR, Ecology 29: 133-145 (1948).