STATUS OF THE PLAINS POCKET MOUSE (*PEROGNATHUS FLAVESCENS*) AT THE TWIN CITIES ARMY AMMUNITION PLANT, 1999

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Introduction

The plains pocket mouse (*Perognathus flavescens*) is the only member of the rodent family Heteromyidae found in Minnesota (Hazard, 1982; Jones and Birney, 1988). Although widely distributed in North America from the Texas panhandle to North Dakota and Minnesota, the behavior and ecology of this mouse is not well known. One or a few individuals are occasionally detected by mammalogists and ecologists, typically in open or disturbed sandy soils supporting no more than a partial cover of grass or scattered forbs and grass (Hibbard and Beer, 1960). In Minnesota, where this pocket mouse reaches its northeasternmost limits of distribution, the species is officially considered to be on the Species of Special Concern list.

A few individual *Perognathus* were trapped at the Twin Cities Army Ammunition Plant (TCAAP) as part of a survey of small mammals conducted by Jannett (1996). Subsequently, Birney and Monjeau (1997) trapped extensively at the TCAAP for this species in June of 1997 and discovered a substantial and apparently healthy population (45 individuals known to be alive at the time) living in the Gravel Pit just west of Hamline Ave. and south of Anoka County Road I. During the 2 years since Birney and Monjeau conducted their study, the future use and ownership of the TCAAP has been under considerable debate and of interest to conservationists, politicians, developers, and various units of both state and federal military organizations (Galli, Pers. Comm.). Birney and Monjeau recommended that

this population should be carefully protected from human disturbance and monitored regularly in an effort to ensure the long-term survival of the only substantial population of this species presently known for the state.

It was the purpose of this study to conduct a follow-up study to that done by Birney and Monjeau to determine: 1)the present status of the TCAAP population of *Perognathus flavescens*; and 2) what proportion of the population marked in 1997 can be determined to remain alive compared to the proportion of the present population that represents new recruits from the population's breeding efforts in 1997 and 1998. Vegetation changes in the area of primary habitat and changes in the total assemblage of small mammals living there also were noted in an attempt to predict the long-term suitability of the site for *Perognathus*, given the potential for human disturbance in an urban area and the natural successional trends of this part of Minnesota.

Methods

A livetrap grid consisting of 201 Sherman live traps was set out on approximately 4.2 hectares in the Gravel Pit area of the TCAAP in the afternoon of 28 June 1999 (Fig. 1). One 3-by-3-by-9 inch trap was set at each station. The 23 north/south trap lines varied in length from 2 to 20 trap stations with a mean of 8.74 traps each. The easternmost line was considered line 1, with other lines numbered sequentially to the west. Line 1 was approximately 25 m west of the edge of Hamline Ave., line 19 passed just a few meters east of the eastern edge of the small lake in the bottom of the pit, with lines 21 – 23 being on the small, relatively open sandy area immediately north of the lake. The northernmost traps in lines 8 –18 were set just at the south edge of the steepest part of the slope on the north side of the pit. The length of lines to the south was determined by the road leading from Hamline to the lake (lines 1 – 7), the presence of dense, grassy vegetation on the south edge of the pit (lines 8 – 13 and 17 - 19), the presence of a deep ditch (lines 14 – 16), or the thick stand of aspens growing near the north shore of the lake (lines 20 – 23). Trap spacing was determined by pacing, with each pace estimated to be 1 meter, and traps set approximately 15 meters apart. An attempt to make the lines parallel at a constant distance of 15 meters was less than fully successful. Before traps were picked up the distance across each end between trap lines was paced and those distances are shown on the figure and were the values used to estimate

total size of the grid. Mean distance between traplines on the north end was 17 meters and that on the south end was 16 meters.

Traps were baited each evening about 2 – 3 hours before sunset with a mixture of rolled oats lightly laced with peanut butter to add odor. They were checked and closed each morning beginning at about 0630 and finishing when the last animal had been released, typically 2 – 3 hours after beginning. After the 4th day of trapping (traps set in evening of 1 July) the traps were left closed for 1 night to allow animals consistently captured early in the evening a night of natural foraging and to allow the population time to move freely on the grid to better meet the assumptions of the Lincoln-Petersen density estimator so that the last night captures could be used as the recaptured population. The 5th night of trapping involved setting the traps in the evening of 3 July and checking and closing them the morning of 4 July. At the time of capture each animal was uniquely toe-clipped if not previously marked, weighed to the nearest 0.1 gram with a 50-gram Pesola scale, and sex was determined. Toes that were removed for purposes of individual marking were preserved in special preservative for genetic analyses to be conducted at a later date to gain some insight into the genetic diversity of this potentially isolated population. In addition, certain qualitative aspects of the substrate and vegetation were noted along with any obvious observations relating to the status of the animal, such as pregnant, torpid, escaped during handling, or juvenile pelage.

Results

Four species of small mammals were captured during the 5 nights of trapping. These were the 13-lined ground squirrel (*Spermophilus tridecemlineatus*), plains pocket mouse (*Perognathus flavescens*), white-footed mouse (*Peromyscus leucopus*), and meadow vole (*Microtus pennsylvanicus*). Minimum number known alive for each species was 2, 36, 21, and 49, respectively (Table 1). A Lincoln-Petersen estimate of total population size was not calculated for the 13-lined ground squirrel, but was 52 for the plains pocket mouse, 24 for the white-footed mouse, and 66 for the meadow vole.

No animal of any species marked by Birney and Monjeau (1997) in June of 1997 was recaptured in 1999. The sex ratio of pocket mice captured in 1999 was heavily skewed toward females, with 6 males and 30 females recorded. Body mass ranged from 7.0 to 17.0 grams with a mean of 10.4 for females and from 9.0 to 12.0 and mean of 10.6 for males. One female was recorded as being pregnant based on abdominal size and body mass (17 grams)

and another was recorded as a juvenile based on body mass (7 grams) and characteristics of the pelage. A female that weighed 13.0 grams probably was pregnant, and some others might well have been pregnant as animals were handled as gently as possible and not palpated for detection of embryos. Males of 10 grams and larger typically had scrotal testes.

Vegetation density on the 48 pocket mouse capture sites averaged 1.12, range 1 - 2, on a 3-category scale of sparse, low, and high vegetation. A sketch map of the gridded area showing trap sites of capture for the plains pocket mouse is presented as Fig. 2. For comparison with potentially competitive species, comparable maps for capture sites of white-footed mice and meadow voles are provided as Fig. 3 and Fig. 4.

Discussion and Recommendations

Comparison of 1997 and 1999 results: Perognathus flavescens.--In 1997, Birney and Monjeau captured 45 individual *Perognathus flavescens* a total of 70 times in1112 livetrap nights during 5 nights of trapping. In 1999, the comparable numbers are 36 individuals trapped a total of 48 times in 1005 livetrap nights, also in 5 nights of trapping. When corrected for total trapping effort and tested by Chi Square, neither of these represent a statistically significant difference between the two years, although the difference in total number of captures approaches significance. In both years the number of pocket mice captured increased from the beginning to the end of the trapping period. In 1999, this increase was exceptionally great with 0 pocket mice captured the 1st night, 2 the 2nd, 7 the 3rd (6 unmarked), 10 the 4th (8 unmarked), and 29 the 5th (20 unmarked). This suggests that a sizable proportion of the total population was not trapped during the 5-day period, which is supported in part by the Lincoln-Petersen estimate of 52 individuals for the population living on the grid at that time.

Birney and Monjeau used transect lines instead of a grid in an attempt to investigate the occurrence or lack thereof of pocket mice in more habitat types. This difference has several possible implications, including the possibility that their capture success was much greater in prime open, sandy habitat and thus that the number of pocket mice in prime habitat might have been somewhat lower in 1999 than in 1997. Secondly, the use of transects makes any estimate of area sampled unreliable, and thus they did not make any effort to estimate density. Using the rough but undoubtedly close estimate of 4.2 hectares for the trapping grid and not adding dispersal distance (which is unknown for this species) to estimate area of grid

influence, density estimates of 8.6 and 12.4 pocket mice per hectare are generated from the minimum number known alive and the Lincoln-Petersen total population estimate, respectively. The grid probably covered more than 50% of the prime habitat available in the Gravel Pit, and at least a few individuals undoubtedly occur in associated but peripheral habitat of lower quality. Thus, one could guess that the total population of pocket mice in the Gravel Pit at the time of this survey probably was 100 or greater, but very likely not more than, say, 200 individuals. If this admittedly somewhat extrapolated estimation bares even a remote relationship with reality, this population probably is and will always be a candidate for extinction, as least for stochastic reasons if not from inbreeding or disturbance. That risk will be exacerbated by any reduction in habitat area, caused either by human disturbance or by successional changes in the vegetation of the area that would lead to taller or more dense plant communities and a reduction of open, sandy patches.

Comparison of 1997 and 1999 results: the small mammal assemblage.--Perhaps of greater significance than the difference observed in total numbers of pocket mice captured between 1997 and 1999 was the marked change in the total small mammal assemblage detected. In 1997, Birney and Monjeau found a nearly pure monoculture of *Perognathus* in the Gravel Pit—70 of 79 total small mammal captures were of this pocket mouse. In addition to the plains pocket mouse, they recorded one capture of the big short-tailed shrew (*Blarina brevicauda*), two of the white-footed mouse, five of the meadow jumping mouse (*Zapus hudsonius*), and 1 of the meadow vole. In 1999, the meadow vole was the most abundant small mammal on the grid, based on both total number of individuals trapped and the Lincoln-Petersen population estimate. The white-footed mouse also was much more common in 1999 than in 1997. I cannot explain the absence of jumping mice and shrews in 1999 as the overall habitat looked even better for these two species than it did in 1997. The most disturbing observation was the abundance of the meadow vole, a species that prefers dense grass cover over sparse grass in partially open sand. The abundance and relatively even distribution of this vole throughout the grid (Fig. 4) is a clear manifestation that the vegetation on the site is becoming more established and mature with significantly more grass than in the recent past. If this trend continues, I would predict that much of this area will cease to support a large *Perognathus* population. Even a 50 or 75% reduction in the average annual population of pocket mice would greatly increase the probability of extinction over a period of years. The

dramatic increase in the population of white-footed mice is potentially serious, but much less ominous than the increase in number of voles. This mouse was typically captured in traps beneath or at least near the aspen trees near the lake, along the north end of the western traplines, and the occasional tree elsewhere on the grid (Fig. 3). Although the presence of trees in and near the Gravel Pit certainly do not favor *Perognathus*, population size and density would have to increase dramatically over many years to represent a serious threat to the *Perognathus* population. Nevertheless, the successional trend on the sandy portions of the Anoka Sand Plain is toward oak-dominated habitats, and in the long-term absence of any habitat management this site too would change in that direction.

Is the TCAAP population of Perognathus *isolated*?—Given the available data, there is no way to provide a definitive answer to this question, but certainly this is a question in need of an answer. The fact that Jannett (1996) was able to capture a few specimens of the plains pocket mouse elsewhere within the TCAAP suggests that the TCAAP population is not limited to the Gravel Pit. However, Birney and Monjeau did set livetraps in what they judged to be possible habitat for the species outside of the Gravel Pit and caught no representatives of the species. That suggests that the Gravel Pit population is the primary TCAAP population, even though the chances are good that at least a few individuals survive and breed elsewhere within the TCAAP. It is likely that the species already occurred in the vicinity of the Gravel Pit prior to its excavation. I can personally recall purchasing gravel from the site approximately 20 years ago. Tons of gravel were being removed each day, and the amount of disturbance was so great that it is unlikely any small mammal species could have prospered in the active portion of the pit. However, peripheral areas that had not been mined for even a year or two might already have provided good if not ideal habitat for this pocket mouse.

As Birney and Monjeau pointed out, the presence of the plains pocket mouse from elsewhere on the Anoka Sand Plain, including a recent capture at the Bunker Hills Golf Course (Moriarity, Pers. Comm.), suggests that at one time this species might have been widely distributed in eroded and otherwise naturally disturbed sandy habitats throughout this area going clear back to pre-Columbian times. However, in the 50+ years since the TCAAP was established, it has become completely surrounded by urbanization. It is difficult to imagine successful dispersal movements of even an occasional pocket mouse through the maize of houses, streets, and businesses that would be necessary for the TCAAP population to

communicate genetically with any other population today. As noted by Birney and Monjeau, it was the human disturbance associated with gravel mining that created this small patch of unique habitat that presently supports this special population of pocket mice, and at the same time it is the threat of additional human disturbance to the area that makes the population so vulnerable.

Management recommendations.—The management recommendations presented by Birney and Monjeau remain basically sound. However, owing to the plans for significant changes in the way the property that now is the TCAAP will be used in the immediate future, these plans need to be revisited now and at regular intervals thereafter if this unique ecosystem, and especially this population of pocket mice, is to survive.

Long-term monitoring will be essential to the management of this population. Two years passed between the 1997 and 1999 censuses, and that time interval might be adequate as long as each census detects the presence of a substantial and apparently healthy and viable population. Both the vegetation and the total small mammal assemblage composition should be considered as part of each census. Reasons for this are considered below in the section on Habitat Protection from Successional Trends. It might become necessary to disc or otherwise disturb the vegetation to maintain it in an early successional sere with sparse grass and some open sandy areas that provide suitable habitat for pocket mice but not for voles and most other small mammal species of the area. If this does become necessary, I suggest that no more than 25% of the area presently supporting pocket mice be disced in any given year. During each monitoring session, enough tissue (e.g., blood or toes) should be taken from each animal that genetic analyses can be conducted to also monitor the genetic status and health of the population.

Habitat protection from human disturbances will be crucial to the long-term survival of this ecosystem. It will be essential to keep most human-related activities in the Gravel Pit and a sizable surrounding buffer area to a minimum if this ecosystem and associated species are to persist at the site. In addition to the obvious disastrous effects of any high-traffic use of the area for housing, business, paved roads, and the like, even allowing development to encroach enough that children, dogs, and cats would be allowed to frequent the area would bring about substantial habitat alteration. Although some of that disturbance conceivably could set back succession and thus benefit this pocket mouse population, the risk

of excessive predation by cats, soil compaction, and the like is too great for managers of the area to take.

Habitat protection from successional trends also will be an important part of the management strategy for this population of plains pocket mice. Despite the importance of minimizing unwanted human disturbance, some habitat management, such as periodic discing, might be necessary in the near future. This suggestion is based on the marked increase noted in the composition, height, and density of grasses and other vegetation on the site and the remarkable increase in the population of meadow voles living there in 1999 as compared to 1997. In addition, the increase in number and size of trees will eventually be a problem if they are not managed. It was noted that some aspen trees had been cut off near the base, probably in response to recommendations in the Birney and Monjeau report of 1997, but that is not adequate. Such trees simply send up sucker shoots and grow back even thicker than they were before. Complete removal or chemical (e.g., roundup or similar herbicide) treatment probably will be necessary to control the natural trend toward increase in woody vegetation.

Literature Cited

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Table

Table 1. Temporal capture pattern and selected population parameters presented for four genera of small mammals livetrapped on a 201-trap grid in the Gravel Pit, TCAAP, 28 June – 4 July, 1999.

Parameter	*Perognathus*	*Peromyscus*	*Microtus*	*Spermophilus*
Night 1	0	7	11	
Night 2	2	10	14	
Night 3	7	13	15	1
Night 4	10	10	14	
Night 5	29	14	30	1
Known Alive	36	21	49	2
L/P Population Est.	52	24	66	n/a
Min. Density/Ha	8.6	5.0	11.7	0.5
L/P Est. Density/Ha	12.4	5.7	15.4	n/a

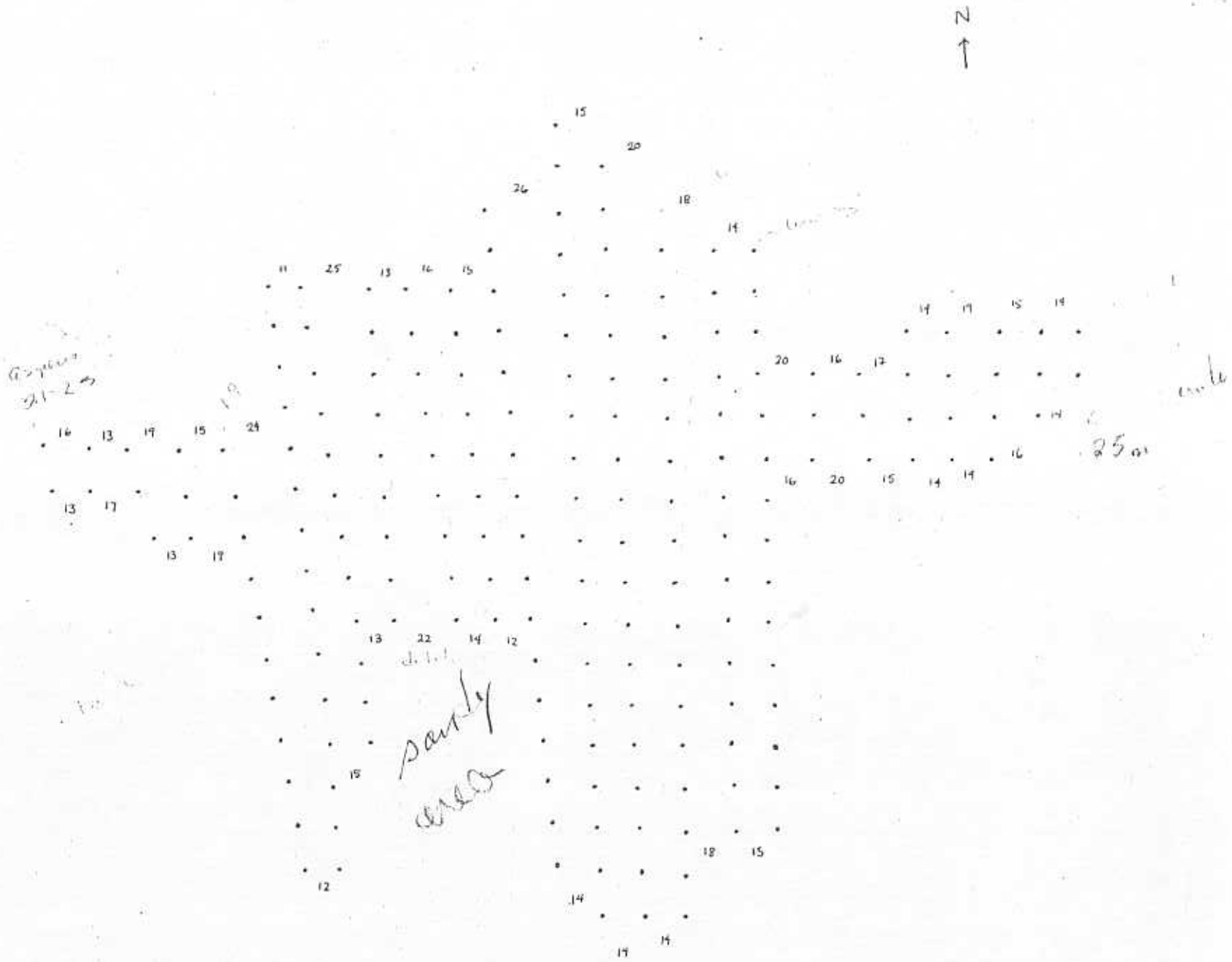
Figure Legends

Figure 1. Sketch map of trapping grid, Gravel Pit at TCAAP, 1999. Hamline Ave. runs north-south just east of the grid. Traplines were numbered 1-23 from east to west. The numbers between traplines are the paced distances between end traps.

Figure 2. Sketch map of trapping grid, Gravel Pit at TCAAP, 1999, showing approximate location of capture sites for *Perognathus flavescens*. See Fig. 1 for orientation.

Figure 3. Sketch map of trapping grid, Gravel Pit at TCAAP, 1999, showing approximate location of capture sites for *Peromyscus leucopus*. See Fig. 1 for orientation.

Figure 4. Sketch map of trapping grid, Gravel Pit at TCAAP, 1999, showing approximate location of capture sites for *Microtus pennsylvanicus*. See Fig. 1 for orientation.



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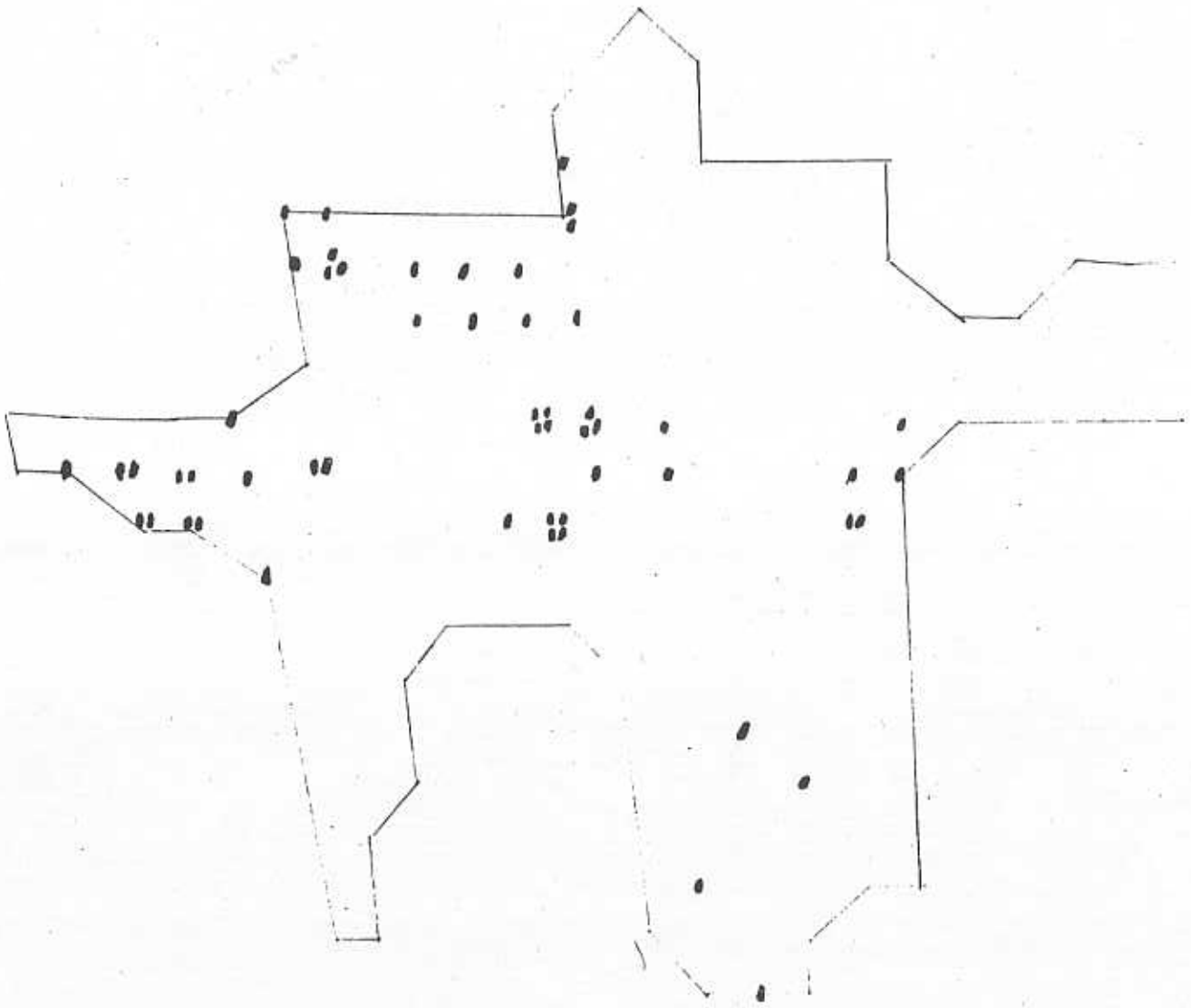

Figure 3. Sketch map of trapping grid, Gravel Pit at TCAAP, 1999, showing approximate location of capture sites for *Peromyscus leucopus*. See Fig. 1 for orientation.