AGENCY FOR INTERNATIONAL DEVELOPMENT
WASHINGTON, D. C. 20523

**BIBLIOGRAPHIC INPUT SHEET**

FOR AID USE ONLY
Batch 58

1. SUBJECT CLASSIFICATION

A. PRIMARY: Food production and nutrition — AH10-0000-0000

B. SECONDARY: Pests of plants

2. TITLE AND SUBTITLE
Comparison of tracking tiles and snap traps for obtaining population indices of Rattus rattus Mindanensis in the Philippines

3. AUTHOR(S)
West,R.R.; Fall,M.W.; Benigno,E.A.

| 4. DOCUMENT DATE | 5. NUMBER OF PAGES | 6. ARC NUMBER |
|---|---|---|
| 1976 | 8p. | ARC |

7. REFERENCE ORGANIZATION NAME AND ADDRESS
Interior

8. SUPPLEMENTARY NOTES (Sponsoring Organization, Publishers, Availability)
(In Philippine agr.,v.59,p.379-386)

9. ABSTRACT

10. CONTROL NUMBER
PN-AAD-696

11. PRICE OF DOCUMENT

12. DESCRIPTORS
Measurement
Philippines
Rats

13. PROJECT NUMBER

14. CONTRACT NUMBER
PASA RA(ID) 1-67 Res.

15. TYPE OF DOCUMENT

AID 590-1 (4-74)

PASA RA (ID) 1-67 Res

PHIL. AGR. 59: 379-386
FEB.-MARCH 1976

# COMPARISON OF TRACKING TILES AND SNAP TRAPS FOR OBTAINING POPULATION INDICES OF RATTUS RATTUS MINDANENSIS IN THE PHILIPPINES

RICHARD R. WEST, MICHAEL W. FALL and EDWIN A. BENIGNO

Respectively, Senior Scientist (deceased), Research Biologists, US Fish and Wildlife Service, International Programs, Wildlife Research Center, Building 16, Federal Center, Denver, Colorado, 80225 USA and Rodent Research Center, College, Laguna 3720.

GCN 1067. UPCA Journal Paper No. 76-145.
Received for publication 26 January 1976.

**Data from standard lines in which snap traps were alternated at 20-m intervals with tracking tiles suggested that tiles may be more suitable for assessing changes in rat activity in dense populations under some Philippine conditions (coefficient of variation for tiles was 15.15, while that for traps was 28.74). In situations where carcasses are not required, inked tracking tiles may provide a less variable index of relative abundance with less effort.**

## INTRODUCTION

One technique commonly used to study rodent population is the standard trap line, usually consisting of 25 to 50 traps set at regular intervals in a straight line (Stickel, 1948; Jackson and Strecker, 1962; Southern, 1965; Hansson, 1967; Taylor, 1971). Such lines are often used for surveying species present, determining population changes, or assessing the effect of reductional measures. Under some circumstances, data from trap lines may be used to estimate the actual number of animals present (Hayne, 1949; Zippin, 1958). Many trapping designs using snap traps or live traps have been advanced with the hope of providing more reliable indices of population size and additional biological information. Stickel (1948) concluded that lines of traps are not a fully reliable means of measuring relative abundance of small mammals, and standard trap lines are still widely used for this purpose because of their convenience and their relatively low cost.

To reduce the time and effort involved in trapping and to avoid the inevitable disturbance of the population being studied, Elmen et al (1957) developed a simple means of assessing rodent population activity using small wood platforms to collect droppings or other evidences of activity. An initial trial of a similar method in Philippine rice fields[1]

[1] F. F. Sanchez, et al. Unpublished Annual Report. Rodent Research Center, 1971.

had somewhat variable results, perhaps due to low rodent density, but indicated visible rodent tracks on the platforms only when the surrounding ground was muddy. Marten (1972) summarized the work of several investigators who used tracking devices to study home ranges and activity patterns of mice and proposed the combination of tracking with a mark-release technique for estimating small mammal abundance. Lord et al (1970) described a technique for comparing rodent populations in different habitats using tracks made on plastic floor tiles, partially covered with printer's ink, to derive an index of relative abundance.

During the latter part of the 1971 dry season, we made a preliminary study of rodent activity on the flood plain of the Chico River at La Paz, Tarlac, using lines of snap traps alternated with inked tracking tiles. This paper presents a preliminary comparison of these two methods for obtaining population indices of *Rattus rattus mindanensis* in the Philippines.

## METHODS

Rodent activity was monitored on three 50-ha plots during April 14-16, April 20-22 and May 18-20, 1971. Rice stubble dominated two plots; cogon grass (*Imperata cylindrica*) and *sakate* grass (*Leersia hexandra*) dominated the third. Monsoon rains began in early May; plowing began in a few of the wet rice paddies during the final survey.

Six 1000-m lines were established 50 m apart in each of the three plots. Twenty-five tiles and 25 traps (Victor 4-way*) were alternately spaced along each line at 20-m intervals (resulting in a tile and trap density of about five each per hectare). Two lines were chosen at random from each area during each sampling period; each line was used only once. Light-colored vinyl tiles (approximately 23 cm square) were inked each afternoon by spreading a small amount (about ½ cc) of printer's ink and a few drops of coconut oil (to prevent drying) over half the tile with a rubber roller. Tracks, on any portion of the tile, were recorded as present or absent each morning. During the morning checks, acetone and cotton were used to remove tracks from the uninked portion of the tiles. Traps were baited with fresh coconut and reset each afternoon at the same time as the tiles. This schedule was followed for 3 days of each period.

## RESULTS AND DISCUSSION

In discussing the analysis of small mammal trapping data, Zippin (1958) noted that, over several nights of trapping, the expected number

* Use of identifying trade names implies neither recommendation nor endorsement by agencies of the Philippine or U.S. Governments.

of animals caught on the first night should exceed the number caught on the second; as the population becomes depleted, it is expected that the size of the catch will decrease from night to night. Bole (1939) suggested that such trapping should generally be limited to 3 days to avoid the invasion of new animals in the trapping area. The general pattern of 3-day catches of *Rattus rattus mindanensis* with standard trap lines in Philippine rice fields has not followed this expectation. Results have been variable from day to day with no evident pattern of decline on the second and third nights. Other investigators have observed a similar pattern of trap-line catches.[2] Presumably, this effect relates to the presence of higher rodent population densities that have been commonly encountered by trap-line studies in other areas, although rapid invasion by new animals could provide an alternative explanation. As in our previous experiences with trap lines in rice fields, the results of the first, second and third nights' trapping in this study showed no consistent pattern of decline or increase; similarly, the results from tracking tiles exhibited no consistent pattern of change (table 1).

These data provide an unusual opportunity to compare the variability of these two similar methods of indexing rodent activity — one which removes animals from a population and one which does not. To permit this comparison, we have assumed that the effects of a 3-night removal of animals from these dense local populations were negligible. We also assumed that 3 nights' exposure of the tiles did not result in habituation of particular animals to their use and that the results of both traps and tiles reflect the same type of rat activity. With these assumptions, we treated the data in the form of nested experiments. Separate analyses of variance were made for traps and tiles and the coefficients of variation were determined for each. Plots, sampling periods, nights, and lines were all considered as random effects. The appropriate F-test for each source of variation was derived from the model shown in table 2.

The components of variance were computed by equating the computed mean square of each component to its expected mean square (EMS). To exemplify: 5.87, the error mean square calculated for traps in the ANOVA was used as an estimate of $\sigma_L^2$ . Proceeding from bottom to top in table 2, the next calculation would be the variance due to nights within sampling period within plots. To calculate the value of this component, 5.87 was substituted for $\sigma_L^2$ , and its expected mean square was set equal to the corresponding computed mean square, thus $5.87 + 2\,\sigma_L^2 = 10.26$ and $\sigma_N^2 = 2.20$. The remaining values for the components were calculated by sequential substitution. The per-

[2] J. P. Sumangil and W. B. Jackson (Personal communication).

Table 1. *Nightly variation in relative abundance indices for* Rattus rattus mindanensis *determined from inked tracking tiles and snap traps in three plots in Tarlac, Philippines. Each plot contained two lines of 25 traps and 25 tracking tiles per line alternated at 20-m intervals*

| Plot[a] | Date (1971) | Day of Trapping | No. rats caught in snap traps | | No. tiles tracked | |
|---|---|---|---|---|---|---|
| | | | Line 1 | Line 2 | Line 1 | Line 2 |
| 1 | Apr 14-16 | 1st | 11 | 12 | 20 | 24 |
| | | 2nd | 7 | 10 | 23 | 23 |
| | | 3rd | 9 | 4 | 23 | 24 |
| | Apr 20-22 | 1st | 9 | 6 | 15 | 13 |
| | | 2nd | 10 | 7 | 16 | 14 |
| | | 3rd | 10 | 10 | 18 | 19 |
| | May 18-20 | 1st | 12 | 14 | 24 | 24 |
| | | 2nd | 15 | 14 | 24 | 22 |
| | | 3rd | 12 | 11 | 24 | 22 |
| 2 | Apr 14-16 | 1st | 4 | 3 | 13 | 18 |
| | | 2nd | 3 | 3 | 15 | 15 |
| | | 3rd | 11 | 6 | 18 | 19 |
| | Apr 20-22 | 1st | 8 | 9 | 11 | 21 |
| | | 2nd | 10 | 10 | 15 | 16 |
| | | 3rd | 10 | 12 | 14 | 20 |
| | May 18-20 | 1st | 4 | 12 | 18 | 16 |
| | | 2nd | 8 | 13 | 21 | 19 |
| | | 3rd | 7 | 7 | 19 | 22 |
| | Apr 14-16 | 1ts | 12 | 6 | 13 | 21 |
| | | 2nd | 5 | 3 | 14 | 23 |
| | | 3rd | 6 | 8 | 17 | 22 |
| | Apr 20-22 | 1st | 2 | 12 | 14 | 17 |
| | | 2nd | 12 | 10 | 23 | 20 |
| | | 3rd | 7 | 5 | 22 | 19 |
| | May 18-20 | 1st | 3 | 5 | 18 | 21 |
| | | 2nd | 11 | 8 | 17 | 25 |
| | | 3rd | 10 | 7 | 22 | 23 |

[a] Plots 1 and 2 contained rice stubble from a crop harvested several months before and plot 3 was within a large, uncultivated tract dominated by grasses.

Table 2. *Models used for determining expected mean squares (variance components) for snap-trap and tracking-tile indices. All sources of variation were considered random effects. Explanation of symbols: P = plot; S = sampling; N = night; L = line*

| ANOVA | | |
|---|---|---|
| SV | d.f. | EMS |
| P | 2 | $\sigma_L^2 + 2\,\sigma_N^2 + 6\,\sigma_S^2 + 18\,\sigma_P^2$ |
| S/P | 6 | $\sigma_L^2 + 2\,\sigma_N^2 + 6\,\sigma_S^2$ |
| N/S/P | 18 | $\sigma_L^2 + 2\,\sigma_N^2$ |
| L/N/S/P | 27 | $\sigma_L^2$ |
| TOTAL | 53 | |

centage contribution of each component to the total variance was then determined by dividing each variance component by the total variance and multiplying the result by 100.

Inked tracking tiles, used at the spacings tested, provided less variable activity indices from *R. r. mindanensis* populations in the three plots than snap traps used in the same manner (table 3). The coefficient of variation for tiles was 15.15% as compared with 28.74% for snap traps, reflecting the somewhat more consistent pattern evident among the tile data in table 1.

A comparison of the variance components for traps and tiles (table 3) shows several differences leading to a variety of interpretations. In both trap and tile data, sampling periods contributed more to the total variance than did nights or plots. The differences among sampling periods indicated by tiles were statistically significant, while those indicated by traps were not. The transition from dry season to wet season, signaled by the beginning of intermittent rain in May, provides one possible explanation for a real difference among sampling periods; however, no other differences were apparent or expected. No real differences in nightly activity or activity between adjacent lines would be expected, although immigration or emigration, erratic fluctuation in the local population, differing responses to darkness or moonlight, or animals' reaction to rainfall might be hypothetical reasons why such differences could be observed. Neither traps nor tiles detected statistically significant differences in these variables. Interestingly, the variation among nights made negligible contribution to the total variance for tiles, but with traps, 16% of the total variance was attributable to this factor. Depletion of the population or social dis-

Table 3. *Summary of analysis of variance of data from traps and tracking tiles, showing F values and the percentage of the total variance contributed by each component. Coefficient of variation for traps was 28.74%, while that for tiles was 15.15%*

| Component | F Value | | Estimate of Variance | | % of Total Variance | |
|---|---|---|---|---|---|---|
| | Traps | Tiles | Traps | Tiles | Traps | Tiles |
| Plots | 1.65 | 1 | 2.11 | 1.83 | 15 | 11 |
| Sampling periods within plots | 2.48 | 7.35** | 3.87 | 6.34 | 27 | 38 |
| Nights within sampling periods within plots | 1.75 | 1 | 2.20 | 0 | 16 | 0 |
| Lines within nights within sampling periods within plots | — | — | 5.87 | 8.40 | 42 | 51 |
| Total | — | — | 14.05 | 16.62 | 100 | 100 |

**Significant at $\alpha = 0.01$.

organization brought about by the removal of animals might provide additional hypothetical reasons to expect real differences, but the proximity of tiles and traps and the lack of directional changes in the trapping data would argue against such explanations. In other studies,[3] typical population depletion patterns in trap catches were observed when trap density was arbitrarily increased to several hundreds per hectare, favoring our preliminary assumption that depletion due to trapping was negligible in these trials.

We found poor correlation among the tile and trap data, probably because of the great nightly variation of trap results corresponding to the more consistent tile indices. We speculate that adding the number of sprung traps to the number of rats captured would provide a less variable index of population activity than trap success alone. This speculation is based on our belief that most of the sprung traps encountered in rice field lines in the Philippines result from rat activity. Provided the presence of bait has no long-distance effect, the first night value of such an index should approximate a similar tracking-tile index minus undetected visits to traps.

To summarize, our results indicated that the values of tracking-tile indices were less variable than those based on trap success under similar conditions and that the contribution of nightly differences to total variation was much less with lines of tiles than with traps. This could mean that the number of sampling nights may be reduced from 3 to 2 or even 1. If a population under study was assumed stable, the less variable tile index may provide an improved means of detecting real changes, in addition to requiring considerably less time, effort and expense. Further study to determine the usefulness of track indices for assessing experimental changes in population activity is desirable.

## ACKNOWLEDGMENTS

This cooperative research was conducted with funds provided by the Governments of the United States and the Philippines. U.S. Government funds were provided to the U.S. Fish and Wildlife Service by the U.S. Agency for International Development under the project, "Control of Vertebrate Pests," PASA RA (ID) 1-67. Philippine Government funds were provided by the National Economic and Development Authority, the Bureau of Plant Industry, and the University of the Philippines at Los Baños. We thank our colleagues at the Rodent Research Center for their help in conducting the study.

---

[3] F. F. Sanchez, et al. Unpublished Annual Reports, Rodent Research Center. 1971; 1973.

## LITERATURE CITED

BOLE, B. P., JR. 1939. The quadrat method of studying small mammal populations. Cleveland Mus. Nat. Hist. Sci. Publ. 5:15-17.

ELMEN, J. T., JR., R. L. HINE, W. A. FULLER and P. J. ALFONSO. 1957. Dropping boards for population studies of small mammals. J. Wildl. Mgmt. 21:300-314.

HANSSON, L. 1967. Index line catches as a basis of population studies on small animals. Oikos (Sweden) 18:261-276. (Biol. Abstr. 49:31826).

HAYNE, D. W. 1949. Two methods for estimating population from trapping records. J. Mammal. 30:399-411.

JACKSON, W. B. and R. L. STRECKER. 1962. Ecological distribution and relative numbers. In: T. I. Storer, ed. Pacific Island Rat Ecology. pp. 45-63. Bernice P. Bishop Museum Bull. 225.

LORD, R. D., A. M. UILCHES, J. I. MAIZTEGUII and C. A. SOLDINI. 1970. The tracking board: a relative census technique for studying rodents. J. Mammal. 51:828-829.

MARTEN, G. G. 1972. Censusing mouse populations by means of tracking. Ecology. 53:859-867.

SOUTHERN, H. N. 1965. The trapline index to small mammal populations. J. Zool. (London). 147:217-221.

STICKEL, L. F. 1948. The trap line as a measure of small mammal populations. J. Wildl. Mgmt. 12:153-161.

TAYLOR, K. D. 1971. Assessment of lossess due to rodents, 3.2.1/-3. In: L. Chiarappa, ed. Crop Loss Assessment Methods, FAO, Rome.

ZIPPIN, C. 1958. The removal method of population estimation. J. Wildlife Manage. 22:82-90.