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A PRELIMINARY ASSESSMENT OF DISTRIBUTION AND ABUNDANCE OF RABBITS IN LAND SYSTEMS IN THE NORTHERN TERRITORY

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The European rabbit, *Oryctolagus cuniculus*, was the last of the feral mammals to reach Central Australia. The rabbit had reached the N.T. border from NW South Australia in small numbers by 1901 (Murray, 1904a). At the same time it had reached Lake Amadeus and was close to the Cleland Hills (Murray, 1904b). By 1915 it was well established on the Hale River near Arltunga (Day, 1916) and by the mid-1920s it had reached the Tanami Desert area (Terry, 1927). In the eastern N.T. the rabbit had probably reached the N.T. along the Georgina River by 1920 (Myers, 1970). There can be little doubt that the distribution of the rabbit was aided by human transport, but the establishment and spread could only have occurred during good seasons (Griffin and Friedel in prep.).

In our study we are attempting to provide an accurate map of the distribution and density of rabbit warrens in Central Australia. This project is part of a larger project to examine the biology of the rabbit in Central Australia and to assess the cost and effectiveness of various control techniques. Accurate determination of the distribution will also enable the suggestion that rabbits are still spreading north to be assessed.

METHODS

Historical distributions have been determined from writings of early explorers and surveyors. These have been summarised by Kimber (in lit. 1981) and Griffin and Friedel (in prep.).

Preliminary assessment of the present distribution of warrens has been made from ground surveys covering over 1300 km through 35 of the 88 Land Systems in the Alice Springs District, aerial photographs ranging from a scale of 1:3000 to 1:25000, occasional aerial surveys

and reports from various sources including initial response to a postal survey of property managers.

An index of abundance was determined by counting warrens along road transects through each Land System. Transect width varied from 50 to 200 m on each side of the road.

RESULTS

The present known distribution of rabbits in the N.T. is concentrated in the southern third of the Territory (Fig. 1). The main distribution is south of the MacDonnell Ranges through the pastoral areas centred between the Finke River and the western desert areas. The major concentrations are on Owen Springs, Palmer Valley, Mt. Ebenezer, Erldunda, Kulgera, Umbeara and Mt. Cavenagh. Areas of high population are also present east and west of this central region wherever habitat is suitable such as in the Petermann Range. Isolated populations also extend out into the sand dunes of the Simpson and western deserts.

Several populations are found north of the MacDonnells. These are on the Titra Land System on New Haven and Central Mt. Wedge Stations, the Hale River area of The Garden and Ambalindum, and in the adjacent limestone areas of Bond Springs and Yambah Stations. A diffuse population occurs throughout the salt lakes on Central Mt. Wedge, Napperby and Narwietooma. Several isolated populations occur as far north as Tanami, Wave Hill, Rockhampton Downs and Lake Nash. These populations occur mainly in limestone or hilly areas.

Abundance of warrens is related to Land Systems in Table 1. Three of the Land Systems have more than 10 warrens per km of transect, equivalent to about 25 warrens per km^2. Only two Land Systems have been surveyed that have no warrens. There is considerable variation in the abundance through the Land Systems as shown by the coefficient of variation.

DISCUSSION

The distribution we have shown is a preliminary estimate of the present distribution. Differences between the distribution we have

summarised and that shown by Petty et al (1979) reflect more accurate mapping rather than a change in distribution.

Despite recurring fears by some, rabbits probably reached their greatest and most northerly distribution shortly after 1920 (Griffin and Friedel, in prep.). As Ratcliffe (1959) suggests, the initial invasion of rabbits probably advanced into environments with which they could not cope during stress periods. Following large-scale die-offs during droughts such as the 1920s in the Bundey River area (R. Holt, pers. comm.) and following invasion of myxomatosis in 1951 at Central Mt. Wedge (W. Waudby, pers. comm.) rabbits in some of the northern reaches of the distribution have never regained the densities reached during the initial invasion. Evidence of the earlier distributions still exists in the form of extinct-warren mounds on properties such as Atula, Tobermory, the Bundey River area NE of Alice Springs and Central Mt. Wedge NW of Alice Springs. Reports by A. E. Newsome (in lit. 1979) indicate rabbits existed on Newcastle Ck, Wave Hill and in the Tanami desert in the late 1950s. Small isolated populations still exist in some of these areas (Corbett, pers. comm., Johnson, pers. comm.) but have not moved further north. Typical of these northern populations is the one at Mosquito Ck on McLaren Ck Station which was present in 1940 (W. Waudby, pers. comm.) and still exists in small numbers (Stock Insp. pers. comm.).

In the southern part of the N.T. populations have exploded and crashed on average once a decade since the turn of the century, but distribution has not changed much since about 1920. A possible exception may be in the Simpson Desert where rabbits may have moved down the Hale R. floodout during or after the heavy rains of the 1970s. However, a cursory aerial survey of these populations indicates these may have died back as a result of the incipient drought of 1980. Sand dunes leave no permanent record of rabbit warrens, so historical information is difficult to obtain.

Distribution of warrens within Land Systems (L.S.) is quite variable, not surprisingly, since rabbits choose the most suitable habitat for warrens while Land System mapping is done on a scale suitable for mapping manageable units. The most variable densities are

in the highly variable Ambalindum L.S. where warrens are concentrated along the Hale River and in a few isolated limestone terraces. Warrens in all Land Systems tend to concentrate in restricted sub-units making up only a small portion of the L.S. However, in Muller, Outounya, Finke, Cavenagh and Ebenezer Land Systems, the preferred sub-units make up a large part of the L.S. and warren distribution tends to be more regular.

Rabbit warrens are most closely associated with limestone soils and outcrops, sandy soils, particularly with limestone at depth, salt lake fringes and alluvial fringes of hills, and along stream banks where soils are suitable for digging. The association between limestone areas and warrens is particularly marked in the north-western fringe of the distribution where most known isolated populations are associated with an outcrop of limestone. The fringes of the salt lake Amadeus Land System also carries rabbits over the extent of its range, e.g. Napperby Lakes, western desert salt lakes, and Karinga Ck. This is probably due to the permanent vegetation, *Melaleuca* sp. or samphire, and friable soils around these lakes. Sandy areas are favoured habitat in the southern part of the N.T. During good seasons high populations have been present in the Simpson Desert dune systems well down the Hale R. and scattered locations in the western deserts (Fig. 1). River front L.S. such as the Finke support high densities of rabbit warrens. However, north of the MacDonnells the Sandover, McGrath and McDills L.S.s carry none or few rabbits. This appears to be a result of the associated complex of Land Systems and lack of suitable soils. An additional factor may be the relative unsuitability of temperature and humidity which may inhibit establishment through reproductive failure (Cooke, 1977).

In conclusion, distribution of rabbits in the N.T. has reached a stable state. However, drought and disease cause populations to die back, sometimes to the point of localised extinction. During good seasons the populations expand to reoccupy suitable habitat. In general, rabbits are concentrated in a moderately small portion of the N.T. although small populations are widely scattered in the southern third of the N.T.

TABLE 1

FREQUENCY OF RABBIT WARRENS ALONG TRANSECTS THROUGH LAND SYSTEMS OF THE NORTHERN TERRITORY, 1980/81

Land System		No. Transects	Total Distance (km)	Warren/km	S.D.	C.V.
Outounya	(Ou)	3	20.0	14.1	10.1	.7
Finke	(Fi)	7	24.1	13.2	7.9	0.6
Cavenagh	(Cv)	4	44.3	10.1	7.4	.7
Muller	(Mu)	17	26.6	8.6	6.9	.8
Ebenezer	(Eb)	4	15.6	8.5	4.3	.5
Kalamerta	(Kl)	2	6.4	7.8	-	-
BondSprings	(Bs)	11	86.2	6.8	5.0	.7
Chisholm	(Ch)	16	52.6	6.7	5.2	.8
Ambalindum	(Ab)	22	42.2	6.2	22.5	3.6
Alcoota	(Ac)	9	32.2	5.7	6.9	1.2
Lindavale	(Li)	17	90.9	5.3	3.3	0.6
Britten Jones Ck	(Si)	2	33.1	4.3	-	-
Harts	(Ha)	8	27.4	4.2	2.9	0.7
Amadeus	(Aa)	7	37.4	3.9	4.0	1.0
Huckitta	(Hu)	5	28.0	3.7	1.9	0.5
Coughlin	(Co)	2	12.4	2.5	1.3	0.5
Ewaninga	(Ew)	1	6.3	2.1	-	-
Titra	(Ti)	39	149.9	2.0	3.3	1.7
Rumbalara	(Ru)	5	19.5	1.8	1.5	0.8
Hamilton	(Hm)	6	18.3	1.5	1.4	0.9
Chandler	(Cn)	1	10.0	1.3	-	-
McGrath	(Mg)	5	8.8	1.3	0.9	0.7
Renners	(Rn)	1	8.3	1.2	-	-
Simpson	(Si)	26	223.9	1.1	2.3	2.1
Kanandra	(Kn)	5	19.0	0.9	0.7	0.8
Gillen	(Gi)	10	52.2	0.7	1.2	1.7
Todd	(Td)	5	49.6	0.5	0.7	1.4
Pulya	(Py)	3	19.7	0.5	0.6	1.2

TABLE 1 (Cont'd)

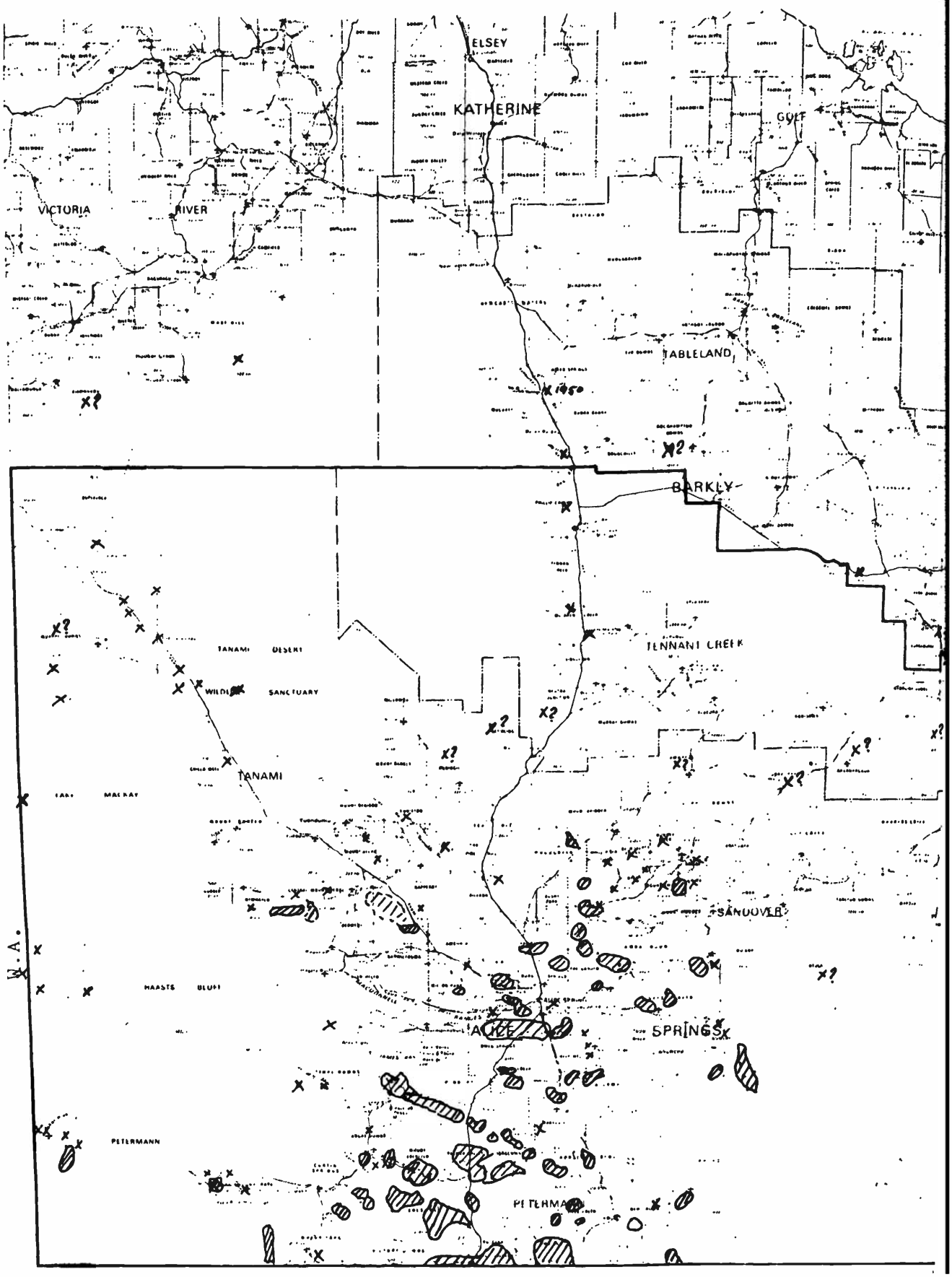
Land System		No. Transects	Total Distance (km)	Warren/km	S.D.	C.V.
Boen	(Bo)	5	21.5	0.4	1.0	2.5
Indiana	(In)	2	4.8	0.2	-	-
Ringwood	(Ri)	5	32.6	0.2	0.4	2.0
Endinda	(Ed)	13	88.5	0.1	0.2	2.0
Singleton	(Sn)	6	30.5	0.1	0.2	2.0
Sandover	(Sa)	4	16.9	0	0	0
Sonder	(So)	1	2.0	0	-	-

Note: S.D. = Standard deviation

C.V. - Coefficient of variation = $\frac{SD}{Mean}$

Fig. 1 Location of Rabbit populations in the Northern Territory

▨ - Present heavy population, ▨ diffuse light population
X - isolated occurrence
X? - exact location not known



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