

THE ECOLOGY AND MANAGEMENT OF *TRICHOSURUS*

SPECIES (MARSUPIALIA) IN N.S.W.

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PREFACE

The work reported in this thesis was conducted by the author while in the Department of Zoology of the University of New England. The thesis contains no material submitted previously for a degree at this, or any other University. Information derived from other researchers has been specifically acknowledged in the text and a list of such publications is appended. Unpublished works are acknowledged as personal communications.

R.A. How

December, 1972.

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SUMMARY

The aim of the research was to determine the ecology of the brush-tailed possum *Trichosurus vulpecula*, and the mountain possum *T. caninus*, and to permit their management in pine plantations in such a way that these indigenous species were not threatened and that the pine plantings were safe from possum attack.

The study was conducted along three complementary approaches between 1967 and 1972. From a review of literature on possum damage, from a questionnaire and from surveys of damaged areas, the distribution, extent, significance and type of damage attributable to *Trichosurus* species in pine plantations was determined. From a capture-recapture programme at Clouds Creek in north-eastern N.S.W. and caged studies at Armidale, the structure and function were determined for populations of both species. An assessment was made on the effects of perturbations on populations of these species for their possible assistance in formulating effective management procedures.

Trichosurus damage to pine plantations was most severe in north-eastern N.S.W. and was generally confined to the smaller plantations (<50 ha.) in this area. In nearly all cases of possum damage in north-eastern N.S.W., the planting attacked was surrounded by indigenous vegetation of wet sclerophyll forest or rainforest type. The *Pinus* species most frequently and severely attacked were *P.elliottii* and *P.taeda* but in many arboreta nearly all species of pine planted were destroyed. Damage was infrequently reported to

P.radiata and *P.patula* in plantations.

Damage to pines by *Trichosurus* was always to trees 10 years of age or older, and consisted of the stripping off of the bark, such that the tree had severe bark wounds or was ringbarked. The significance of this damage ranged from a reduction in the log length available for milling, by deforming the tree, to rendering whole compartments economically useless. It also disrupted the scientific assessment of certain pines in arboreta for their future value as commercial species.

Although there has been considerable research on many aspects of *T.vulpecula*, there has been very little work carried out on *T.caninus*, which is the major pest species in pine plantations in north-eastern N.S.W. As a result, the research in this study was concentrated primarily on *T.caninus*.

Vaginal smears of caged *T.caninus* showed that there was little difference between the duration of the oestrous cycle and gestation period of this species (26.7 days and 16.0 days respectively) and those of *T.vulpecula* (25.7 days and 17.5 days respectively) described by previous workers. In natural populations at Clouds Creek the season of births for *T.caninus* peaked nearly a month before that of *T.vulpecula*. No pronounced secondary season of births occurred in either species at this locality. In *T.vulpecula* all females over one year old bred annually, but in *T.caninus*, not all females were parous until three years of age. Only 50% of the two year old females bred, and the

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annual fecundity was also less than one in several adult age categories.

T.vulpecula young grew and developed more rapidly than *T.caninus* young and began to leave the pouch after 135 days of age. *T.caninus* young began to leave the pouch only after 175 days old. The period of maternal dependence after leaving the pouch also differed interspecifically, as *T.vulpecula* survived independently of their mothers after 175 days, but *T.caninus* were not weaned until sometime after 250 days.

All female *T.vulpecula* were mature by twelve months and males were mature by 16-18 months old. In *T.caninus* maturity was not reached in females until they were 24 months old, and males appeared to reach maturity sometime after 30 months. Dispersal was most frequent in both species prior to and during the period of maturity. *T.vulpecula* males and females dispersed primarily between the ages of 6 and 18 months, but in *T.caninus* dispersal did not commence until 18 months of age in females and 30 months of age in males.

Dependent young survival was high in *T.vulpecula* with nearly 80% of the young reaching independence. The opposite was the case with *T.caninus* as only 36% of the young born survived their first year. Evidence from the present work and other research suggested that a male specific mortality acted on the dispersal age *T.vulpecula* and, it was this mechanism which accounted for the disparity in the adult sex ratio of this species. No evidence of male specific mortality was encountered in the *T.caninus* population, and the sex ratio of the adult

population was parity. The survival of post dispersal age individuals was high in *T. caninus*, but the rapid decrease in the survival of adult *T. vulpecula* during the present study was explained by the high turnover rate of individuals of this species in the areas of its overlap with *T. caninus*.

The density of *T. vulpecula* at Clouds Creek in woodland and pine was 0.370 possums/ha., while the density of *T. caninus* was 0.300 possums/ha. in wet sclerophyll forest. Male and female trap indicated home range means were comparable, with males occupying 7.41 ha. and 7.13 ha. and females 4.66 ha. and 4.85 ha. in *T. vulpecula* and *T. caninus* respectively.

A further major difference in the population structure of the two species was the difference in adult sex ratios. In *T. vulpecula*, males comprised less than 40% of the adult population, but in *T. caninus* males formed around 50% of the adult population. Adult *T. caninus* showed a high intersexual overlap in core areas and there were also four cases where adults, of the opposite sex and with overlapping core areas, were trapped simultaneously in the one trap. From this evidence it was postulated that adult *T. caninus* were permanently paired and presumably monogamous. No evidence was discovered for pairing in *T. vulpecula*, and with all females breeding and females outnumbering males 2:1 it was apparent that this species was polygamous.

Evidence from previous research and that of the present study suggested that *T. vulpecula* populations were regulated by a low survival amongst independent dispersal age individuals. The reason for this

low survival was a product of the inability of these individuals to establish themselves permanently in the already maximally utilised habitat, consequently, the population was regulated proximally by the lack of suitable habitat as determined by the social organisation and dispersion of the resident adult population.

The social organisation and dispersion of the resident adult population also determined population size in *T. caninus* but in this species this was the ultimate regulatory factor. *T. caninus* have evolved a self-regulatory proximal factor which governs population size. It was shown that in 82% of the cases where a *T. caninus* offspring of a previous season resided in its maternal range area, its mother's subsequent young died prior to independence, or its mother failed to reproduce during its residency.

Populations that were subjected to the removal of individuals, or had part or all of their habitat destroyed, were studied to determine the effects of perturbations on them and assess the value of these perturbations as management procedures.

Possums trapped in the pine plantation at Clouds Creek were removed during the four years prior to the commencement of the capture-recapture programme, in an attempt to control possum damage in the plantation. During 1968 a study was made of the effects of this removal on possum populations in the area.

There was a high rate of return of individuals of both species released less than 2.3 km. away from the plantation, but continued

removal of individuals resulted in a decrease in both the estimates of population size and the effort required to trap individuals. The removal study also showed that a high percentage (57%) of the *T.vulpecula* captured in the plantation were of an age when they would be dispersing naturally, this could also have been the case with the *T.caninus* individuals. Indications were therefore that removal was only acting to harvest the population. It was concluded that very little impact had been made on the structure and function of the *T.vulpecula* population by removal, due to the rapid replacement of the adult individuals removed by the mature pre-dispersal individuals that resided in the population throughout the year. Removal would increase the reproduction of the *T.caninus* population if it removed the sub-adult individuals, whose presence restricts the subsequent reproduction of their mothers, or inhibits the survival of their mother's subsequent offspring.

Although removal reduced the population size it did not eliminate possum damage and may have increased reproduction in *T.caninus*. It was not a satisfactory method of controlling *Trichosurus* species in pine plantations.

With partial habitat destruction, some individuals remained in the population depending on the size and nature of the habitat remaining. Clearing of the southern sclerophyll forest removed most of the *T.caninus* population in that area, but it also indicated that a high site attachment occurred in this species with several

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individuals remaining in the remnants of their home range until all was cleared. No nightly movements occurred between the remaining sclerophyll forest and the pine plantation once clearing began.

The destruction of the southern sclerophyll forest showed conclusively that native vegetation was a necessity in an individual's home range if it was to remain in the population. Only three former residents of this area remained in the trap record till the end of the study, and all utilised part of the northern sclerophyll forest in their home range.

No possums of either species resided in the 1950-51 plantation permanently, and no captures were made within the 1965 planting. The conclusion was made that pine plantations were low preference habitats for both species.

Based on the findings of the three approaches, it was possible to propose a viable management recommendation for these species in pine plantations.

Since trees were not susceptible to *Trichosurus* species attack until they were at least 10 years old and possums did not move through or feed in younger plantings, it was recommended that pine plantings should be planted such that older plantings, (which were susceptible to possum attack), were surrounded by younger non-susceptible plantings (through which possums would not move). Damage will eventually occur to trees around the periphery when they reach an age when attack will occur, however, this can be minimised or eliminated by the clearing of a large

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area around the periphery between the pines and the possums natural habitat, or by planting a species of pine not susceptible to attack around the periphery of the plantation.

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