The impact of fire on the honey possum *Tarsipes rostratus* in the Fitzgerald River National Park, Western Australia.

Annika Everaardt BSc (Honours)

This thesis is presented for the degree of Doctor of Philosophy
of Murdoch University, 2003.

I declare that this thesis is my own account of my research and contains as its main content work which has not previously been submitted for a degree at any tertiary education institution.

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Annika Everaardt, November 2003.

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Abstract

The honey possum *Tarsipes rostratus* is a tiny (7 - 12 g) highly specialised flower-feeding marsupial endemic to the south-western corner of Australia. The impact of fire on this small mammal was studied, over a 19-year period, in the Fitzgerald River National Park, a large (330,000 ha) area of relatively undisturbed heathland/shrubland, rich in the proteaceous and myrtaceous plants upon which the honey possum appears to rely for food. The honey possum is the most abundant and widespread mammal in this Park.

Capture rates of honey possums were significantly related to the years since the vegetation was last burnt, annual rainfall in the preceding (but not the current) year, the season when trapping occurred, and the trapping grid operated. Capture rates declined markedly after fire and remained low (less than one third of those in long unburnt vegetation) for about 4 - 5 years following a fire. Rates of capture then increased steadily over the next 20 - 25 years, with maximal abundance recorded about 30 years after fire. Thereafter, there appeared to be a slight decline in capture rates, but even in the vegetation unburnt for longest (> 50 years since fire), honey possum abundance was substantial and relatively stable. In contrast to these changes in abundance, the structure of the honey possum population, with 79 % adults and 57 % males, appeared little influenced by fire history, annual rainfall, season or grid.

The increase in the rates of capture of honey possums following fire paralleled the pattern of availability of cover in the vertical and, to a lesser extent,

horizontal plane. Indeed, projective foliage cover took around 20 years after fire to reach levels similar to those available in areas unburnt for even longer. The trend in capture rates was also congruent with the maturation of the most frequently visited foodplants of honey possums, particularly *Banksia nutans* (summer flowering) and *B. baueri* (winter flowering). Areas long unburnt still contained shelter and foodplants adequate for honey possums even 50 years or more after fire, with only slight evidence of senescence.

Pollen loads indicated that honey possums caught in burnt areas, where their preferred foodplants were absent, continued to feed on these favoured foodplants (*Banksia* and *Dryandra* spp.) at nearby unburnt areas. In addition, they also fed, in both burnt and long unburnt areas, upon a suite of other plant species that regenerated more rapidly from lignotubers and epicormic buds, as well as from seeds (e.g. *Eucalyptus* and *Calothamnus* spp.). Thus, honey possums appeared to persist with their preferences for feeding from a limited number of flowering plants despite some of these species not being available in recently burnt areas for many years. Nearby patches of unburnt vegetation can clearly be important refuges, feeding grounds and shelter for the few honey possums that visit recently burnt areas, and appear to be the source of honey possum colonists in the years following a fire.

Capture rates were also greater following years when rainfall was higher than average. Indeed, rainfall had as great an influence upon capture rates as time since fire. Capture rates were also consistently higher over winter, and to a lesser extent over summer, than in either autumn or spring. Individual grids, even those close together in apparently similar vegetation with a similar fire

history, still differed significantly overall in the capture rates of honey possums. This last finding has implications for the use of chronosequences in the study of post-fire changes in biota.

Although not the primary focus of the study, data on the limited suite of other, far less abundant, small mammals present indicated that house mouse *Mus musculus domesticus* numbers peak soon after fire (about two years after fire), grey-bellied dunnart *Sminthopsis griseoventer* numbers somewhat later (about eight years after fire) and that southern bush rats *Rattus fuscipes fiuscipes*, like honey possums, are later successional species. Most species were present in vegetation over a range of post-fire ages, with data consistent with models based on sequential changes in relative abundance.

Like many Australian mammals, the range of the honey possum has contracted substantially over the last 200 years and the coastal heathlands of the south-west are its last stronghold. In terms of its conservation, this study indicates that, if possible, management burns in these heathlands should be separated by intervals of at least 20 years between successive burns, and preferably even longer. If burns are required more frequently to meet other management priorities, it is highly preferable that they are small and patchy, rather than large scale. Such practices may help ensure the long-term survival of this unique, highly specialised and endemic marsupial.

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