THE POPULATION ECOLOGY OF
THE BRUSH-TAILED POSSUM,
TRICHOSEURUS VULPECULA (KERR), IN
TASMANIA

by

GREGORY J. HOCKING

Being a thesis submitted in partial fulfilment of the requirements
for the degree of Master of Science in Zoology at the University of
Tasmania, Australia.

October, 1981
Frontispiece. The brush-tailed possum, *Trichosurus vulpecula* (Female with offspring approximately 200 days old).
THE POPULATION ECOLOGY OF THE BRUSH-TAIL POSSUM,

TRICHOSURUS VULPECULA

Abstract

Selected characteristics of possum populations occurring in different habitats were examined in a live-trapping study conducted in the commercial hardwood forests of southern Tasmania between August 1976 and September 1979. All habitats originated following the destruction of mature forest by fire. They were selected so as to represent the different stages of regeneration in the post-fire succession from bare ground to forest of Eucalyptus spp. with a rainforest understorey at 60 to 80 years after the fire. Three aspects of the populations were considered: breeding, population dynamics, and growth in body size.

Fecundity varied markedly among populations and resulted from differences in age at maturity, incidence of breeding, and survival of dependent young. Reproductive maturity in both males and females was attained at a significantly later age in older habitats and once attained, the incidence of breeding was maintained at a lower level than in recently burnt habitats. The effect of this reduction in fecundity was reinforced by a reduced rate of survival of dependent young. The potential effect of this reduction in fecundity on population dynamics was assessed and found to amount to a 40% reduction in the intrinsic rate of increase. This range of variation constituted over 70% of the total variation previously recorded over the entire geographic range of the species.

Mark-recapture methods were applied to study the dynamics of the populations. Relative density increased rapidly from a minimum
during the first 6 months following the fire to reach a maximum
by 4-6 years following which density stabilised and later declined
between 40 and 60 years after the fire. Parallel with this was a
change in the sex/age composition of the population. The represent-
ation of young age-classes in the total population was highest in 4
year old habitat, that is just prior to peak density. Males pre-
dominated in habitats up to 4 years old after which the sex ratio
shifted towards equality. These differences in population structure
were explained in terms of the pattern of survival and recruitment
of the subadult and juvenile age classes. Survival between the ages
of 12 and 24 months was critical in determining the rate of recruitment
to the adult population. Age-specific survival was combined with
information on fecundity to derive estimates of the rate of increase.
The latter were found to be consistent with the observed pattern of
change in density. Moreover, although fecundity varied among habitats
the major component of variation in the rate of increase was the rate
of survival.

Growth in body size varied among populations. Both growth
rates and mature size were highest in habitats between 2 and 6 years
old following which there was a steady decline in both statistics
with the age of the habitat. An index of fat reserves was also
derived using a body weight - length relationship. This index also
varied markedly among populations.

The observed characteristics of these populations were correlated
both with one another and with the quality of their habitat. This was
considered to be due to all population parameters responding to variation
in a common environmental factor, namely food quality.
ACKNOWLEDGEMENTS

I wish to express my sincere thanks to my supervisor,
Dr. E.R. Guiler, for his guidance and encouragement during the
course of this study.

In addition I wish to thank the following people and
organisations for their considerable assistance:

- The Forestry Commission of Tasmania and staff for their full
co-operation and assistance during the field work phase of this work.
This work would have been impossible without this help. In particular,
I wish to thank:

Mr. Ken Felton, Principal Silvicultural Research Officer, for his
encouragement and advice, as well as managing all financial matters.

Mr. Dick Chuter, Senior Ranger, Geeveston, for advice, invaluable
assistance whilst I was in the field, as well as ensuring that I had
accommodation in the Forestry Commission quarters when I was in Geeveston.

I also wish to thank the late Mr. E. Korven-Korpinen of Australian
Newsprint Mills, Maydena, for assistance during that part of the field
work conducted near Maydena.

- The Director, Dr. J. Gibb, and staff of the Ecology Division
D.S.I.R., New Zealand, for the opportunity to work within their possum
research group during 1979/80. This experience proved to be invaluable
in the interpretation of the results of the present study. In particular
I would like to thank Mrs. Alice Fitzgerald for making this possible as
well as for her generous hospitality whilst in New Zealand.

Professor B. Johnson for allowing the use of facilities within
the Zoology Department, University of Tasmania, during period of pre-
paration of this thesis.

I also wish to thank the staff and fellow post-graduate students
of this department for assistance, in particular Mr. R. Rose for his
encouragement and helpful advice on matters relating to the reproductive biology of the species.

Mrs. Lyn Wilson for both her enthusiasm and efficiency in the typing of this thesis.

This study was financed by a scholarship and grants from the Forestry Commission of Tasmania.
# TABLE OF CONTENTS

**ABSTRACT**  

**ACKNOWLEDGEMENTS**  

<table>
<thead>
<tr>
<th>Chapter 1</th>
<th>INTRODUCTION</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1</td>
<td>Introduction</td>
<td>1</td>
</tr>
<tr>
<td>1.2</td>
<td>Review of previous work on <em>T. vulpecula</em></td>
<td>3</td>
</tr>
<tr>
<td>1.3</td>
<td>Aims and Approach of the Present Study</td>
<td>6</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Chapter 2</th>
<th>DESCRIPTION OF STUDY AREAS AND GENERAL METHODS</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1.1</td>
<td>Study Region</td>
<td>7</td>
</tr>
<tr>
<td>2.1.2</td>
<td>Description of the Region</td>
<td>8</td>
</tr>
<tr>
<td>(a)</td>
<td>Geology</td>
<td>8</td>
</tr>
<tr>
<td>(b)</td>
<td>Climate</td>
<td>8</td>
</tr>
<tr>
<td>(c)</td>
<td>Vegetation</td>
<td>9</td>
</tr>
<tr>
<td>(d)</td>
<td>Impact of Forestry Activities</td>
<td>10</td>
</tr>
<tr>
<td>2.2</td>
<td>Study Areas</td>
<td>16</td>
</tr>
<tr>
<td>2.3</td>
<td>Field Methods</td>
<td>23</td>
</tr>
<tr>
<td>2.3.1</td>
<td>The Trapping Programme</td>
<td>24</td>
</tr>
<tr>
<td>2.3.2</td>
<td>Handling and Measurements</td>
<td>25</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Chapter 3</th>
<th>BREEDING PERFORMANCE</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.1</td>
<td>Introduction</td>
<td>29</td>
</tr>
<tr>
<td>3.2</td>
<td>Methods</td>
<td>32</td>
</tr>
<tr>
<td>3.3</td>
<td>Results</td>
<td>36</td>
</tr>
<tr>
<td>3.3.1</td>
<td>Breeding Season</td>
<td>36</td>
</tr>
<tr>
<td>3.3.2</td>
<td>Sex Ratio of Pouch Young</td>
<td>39</td>
</tr>
<tr>
<td>3.3.3</td>
<td>Onset of Reproductive Maturity</td>
<td>40</td>
</tr>
<tr>
<td>(a)</td>
<td>Males</td>
<td>40</td>
</tr>
<tr>
<td>(b)</td>
<td>Females</td>
<td>41</td>
</tr>
<tr>
<td>(c)</td>
<td>Probit Analysis</td>
<td>43</td>
</tr>
<tr>
<td>3.3.4</td>
<td>Incidence of Breeding in Females</td>
<td>47</td>
</tr>
<tr>
<td>3.3.5</td>
<td>Emergence from the Pouch and Weaning of the Young</td>
<td>50</td>
</tr>
<tr>
<td>3.3.6</td>
<td>Survival of Dependent Young</td>
<td>53</td>
</tr>
<tr>
<td>3.3.7</td>
<td>Correlations Among Breeding Parameters</td>
<td>57</td>
</tr>
<tr>
<td>3.4</td>
<td>Discussion</td>
<td>62</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Chapter 4</th>
<th>POPULATION DYNAMICS - Introduction</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.1</td>
<td>Trap Response</td>
<td>73</td>
</tr>
<tr>
<td>4.1.1</td>
<td>Introduction</td>
<td>75</td>
</tr>
<tr>
<td>4.1.2</td>
<td>Results</td>
<td>75</td>
</tr>
<tr>
<td>(a)</td>
<td>Short-term Response to Trapping</td>
<td>76</td>
</tr>
<tr>
<td>(b)</td>
<td>Variability of the Trap Response</td>
<td>78</td>
</tr>
<tr>
<td>(c)</td>
<td>Long-term Changes in Trap Response</td>
<td>80</td>
</tr>
<tr>
<td>(d)</td>
<td>The Recapture Response</td>
<td>80</td>
</tr>
<tr>
<td>(e)</td>
<td>The Response of Untrapped Animals to Traps</td>
<td>82</td>
</tr>
<tr>
<td>4.1.3</td>
<td>Discussion</td>
<td>84</td>
</tr>
<tr>
<td>4.2</td>
<td>Patterns of Movement</td>
<td>87</td>
</tr>
<tr>
<td>4.2.1</td>
<td>Introduction</td>
<td>87</td>
</tr>
<tr>
<td>4.2.2</td>
<td>Methods</td>
<td>89</td>
</tr>
<tr>
<td>4.2.3</td>
<td>Results</td>
<td>90</td>
</tr>
<tr>
<td>(a)</td>
<td>Activity</td>
<td>90</td>
</tr>
<tr>
<td>(b)</td>
<td>Home Range Size</td>
<td>93</td>
</tr>
<tr>
<td>4.2.4</td>
<td>Discussion</td>
<td>97</td>
</tr>
<tr>
<td>4.3</td>
<td>Population Dynamics</td>
<td>102</td>
</tr>
</tbody>
</table>
TABLE OF CONTENTS (Cont'd)

4.3.1 Introduction
4.3.2 Methods
4.3.3 Results
   1. The Total Population
      (a) Seasonal Variation
      (b) Age-specific Survival
      (c) Population Dynamics
   2. Populations Occupying Different
      Habitats
      (a) Population Structure
      (b) Survival Estimates
      (c) Population Dynamics
4.4 Population Dynamics - Density Estimation
   4.4.1 Introduction and Methods
   4.4.2 Results
4.5 Population Dynamics - Discussion
   (a) Survival
   (b) Proximal Causes of Mortality
   (c) Population Density

Chapter 5 GROWTH AND CONDITION
5.1 Growth
   5.1.1 Introduction
   5.1.2 Methods
      1. Ageing Criteria
   5.1.3 Results
      (a) Pouch Young
      (b) Juveniles and Adults
         Growth Rates
         Seasonal Variation in Growth
         Body Size in Adults
         Growth Curves
         Body Weight at Reproductive Maturity
   5.1.4 Discussion
5.2 Physical Condition
   5.2.1 Introduction
   5.2.2 Derivation of Methods
   5.2.3 Methods
   5.2.4 Results
   5.2.5 Discussion

Chapter 6 GENERAL DISCUSSION - THE RELATIONSHIP BETWEEN FIRE AND
POPULATION DYNAMICS OF T. VULPECULA
6.0 Introduction
6.1 Differences Among Populations from Different
   Habitats
6.2 The Effect of Fire on the Habitat of T. vulpecula
6.3 The Relationship Between Habitat and Populations
   of T. vulpecula

REFERENCES
APPENDIX A
APPENDIX B
INTRODUCTION