USE OF KINLEITH FOREST BY NATIVE NEW ZEALAND BATS AND EFFECTS OF FORESTRY

A thesis presented in partial fulfilment of the requirements for the degree of Master of Science in Ecology at Massey University, Palmerston North, New Zealand.

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2001

Frontispiece The Redwood Reserve, Galaxy Rd, is frequented by long-tailed bats. Planted in 1927, the redwoods are among the oldest trees in the forest.

ABSTRACT

New Zealand's vulnerable microbats, the long-tailed bat (*Chalinolobus tuberculatus*, Vespertilionidae) and short-tailed bat (*Mystacina tuberculata*, Mystacinidae), are typically tree-roosting and generally associated with indigenous forest. However, bats have been seen at the edge of Carter Holt Harvey Forests' central North Island Kinleith Forest, a 131,000 ha exotic forest predominantly in *Pinus radiata*. Requested by Carter Holt Harvey Forests, this study investigates bat presence and distribution in Kinleith Forest, forest use by long-tailed bats, and the effects of forestry practices on bats, with focus on tree felling operations. It is the first comprehensive study of native bats' use of exotic plantation forest in New Zealand.

A broad-scale bat detector-based survey of 32 disparate sites, and comprising 720.5 km of driving transects over three routes, found long-tailed bats to be widespread in Kinleith Forest. In places activity was high, on some nights exceeding 60 bat passes/hour, or 100 passes/night, and at one site, averaging 46.0 passes/night (n = 189 bat detector-nights from throughout the year). Given the decline in this species elsewhere, it is significant that long-tailed bats are present in some areas from which they were known historically. Mapping of bat sites in relation to forest type indicates long-tailed bats may have a fairly continuous distribution in the central North Island. Results suggest that instead of approaching unsurveyed plantation forests with the expectation that long-tailed bats are absent, they should be assumed present until proven otherwise. Anecdotal evidence of short-tailed bats, and of *Dactylanthus taylorii* — a rare plant they naturally pollinate, indicates short-tailed bats could potentially be present in Kinleith Forest.

Bat activity monitoring in adjacent forest interior and road habitats showed long-tailed bats commonly used roads in young (without canopy closure) and mature *P. radiata* forest, and podocarp broadleaf forest. Bats probably favoured roads for reasons of habitat structure, though roads may also play a role in navigation. This behaviour can be used to advantage when surveying for long-tailed bats in plantation forest.

Survey work identified long-tailed bats to be present in all topographies and a range of habitats including harvested/unstocked land, young *P. radiata* forest, and mature (≥ 17 years) *P. radiata*, *Eucalyptus* spp., *Pseudotsuga menziesii* and *Sequoia sempervirens* forest, wetlands, and native forest remnants. Comparison of 46 "bat habitats" with habitat availability along 194 km of transects revealed long-tailed bats to select older pine forest and generally avoid unstocked land or younger forest. This pattern is supported by findings from monitoring work in young and mature pine forest. Older pine forest retains more heat, has a different understorey, and may offer more shelter than younger forest, potentially influencing insect prey abundance and bat activity. Bats' differential use of habitat may partially explain the lower number of bat encounters in the Wainui area than the Galaxy area. Six sites, including a wetland, older pine forest, and areas in or adjacent to native forest, had high bat activity.

The relative importance of exotic plantation forest and native podocarp broadleaf forest reserve land to foraging long-tailed bats was investigated in a replicated bat detector-based study. Insect abundance and ambient temperature were also monitored. Bat activity and foraging activity were much greater in the plantation forest than the native forest, possibly because of the greater abundance of moths — important prey. Forest type was the best predictor of bat activity.

Anecdotal accounts indicated several bat roosts to be in production trees (*P. radiata*), including old crop trees. One record was of a roost in a barely noticeable crevice in a 30-year-old pine, others were from areas of native forest, rocky crevices and a cave. Four accounts were of communal roosts. There is evidence that maternity roosts may occur in production forest. Most observations were made during the process of habitat modification and so roosts no longer exist. At least one possible communal roost was identified from bat activity data. A review of roosting ecology suggests that while highly mobile, long-tailed bats use many roosts in a small area, often roost near forest edges, are highly selective of roosts, and may face inter- and intra-specific competition for roosts.

Long-tailed bats may be very sensitive to roost site disturbance and habitat fragmentation. Tree felling, an important part of forestry, could threaten long-tailed bats at an individual and a population level by causing injury or death, reducing available habitat, and isolating bat groups. However, tree felling could create foraging (e.g. edge) habitat and facilitate access for bats. Overall, effects are likely to depend on the scale of operations. Other forestry operations which could negatively affect long-tailed bats include site preparation, pesticide use, infrastructure works, transportation and quarrying. Pest mammal control operations and the conservation of cave, wetland and reserve areas potentially benefit long-tailed bats in Kinleith Forest. The complex habitat mosaic may be favourable to long-tailed bats. However, there are many questions yet to be answered. Sensitive management may be needed to ensure bat survival in Kinleith Forest.

Long-tailed bats probably prey on a number of forestry pests including *Helicoverpa armigera* and may be an effective biocontrol agent. Artificial roost boxes could be used to encourage bats in this role and reduce the number of bats potentially harmed in tree felling operations.

ACKNOWLEDGEMENTS

I would sincerely like to thank Carter Holt Harvey Forests who initiated and supported this project, and provided the resources to make it possible. Special thanks go to Robin Black, Bridget Robson and Bill Dyck. I am especially indebted to Robin who helped with logistics, equipment, vehicles (even lending me his), maps, contacts, and funding. Robin also set up and downloaded dataloggers, kept the bat survey going while I was completing course work despite other work commitments, and contributed a detailed knowledge of the forest. Thank you Bridget for your enthusiasm, ideas, useful suggestions and Can Do attitude. The support and assistance of my supervisors, Dr Murray Potter and Dr Ian Stringer is very gratefully acknowledged. Thank you for your encouragement, scientific ideas and suggestions, constructive criticism, statistical advice and help with this manuscript.

I am grateful for the support, company, kindness, skills and humour of many enthusiastic volunteer field assistants who helped in survey work, habitat use studies and bat trapping: A Aislabie, A Allan, R Brown, R Coley, S Dunn, P Eades, B Ebert, S Garner, S Goodwin, S Gray, J Groos, O Long, A McGregor, the Moore family, Y Nakada, S Pilkington, D Redmayne, F Rodwell, the van Rooijen family, M Rose, J Sheat, B Snowsill, C and G Stephenson, and P Wayne. Special thanks to P Murray for the time and skills you contributed and shared, and to South Waikato Forest and Bird and associates for your enthusiasm, encouragement and help.

Many thanks to the teams of Athol Depot, Main Gate and Forest Security for your accommodation of the bat research and generous and valuable assistance in safety and security on a day to day basis. Thank you to N Kourtsidis for drafting and putting communication procedures in place and to G Rahiri for training.

Many people contributed in the background of this project, providing valuable advice and useful suggestions, forest information, bat information, juggling resources, taking messages, tracking down interloans, fixing equipment and being generally helpful. I would especially like to thank J Alexander, A Arkins, B Atkinson, C Baird, K Barber, P Barrett, G Baverstock, D Bomford, P Bradfield, L Cannon, P Cashmore, S Chapman, L Conole, M Cross, B Cuff, D Cunningham, M Daniel, K Davies, L Dickinson, J Dodgson, L Doel, M Douglas, L Downes, S Downs, C Ecroyd, P Fels, P Fletcher, E Forche, R Fordham, S Garner, A Garrick, M Gilbert, B Gilmore, S and C Gray, R Griffiths, G Hall, P Hamana, D Hammond, M Hansen, G Harrison, J Heaphy, I Henderson, K Hughes, G Inman, P Jansen, B Just, M Kay, C Keast, R Lentle, M Lewis, B Lloyd, M Mair, M Martin, P McClelland, L McKendrick, F McKenzie, M McLarin, K Meredith, B Middleton, E Minot, D Neilson, G Newton, C O'Donnell, K Owen, S Papara, S Perrett, S Pilkington, G Portegys, J Powrie, C Preston, M Roche, F Rodwell, R Samson, B Saunders, J Sedgeley, C Smuts-Kennedy, B Snowsill, M Southorn, H Speed, C Speedy, A Stirling, R Summers, S Taylor, P Thomson, C Tozer, D Ward, N Watson, S Webb, H Weenink, K Whyte, M Wilke, D Williams, G Williamson, G Wilson, A Woolhouse, Massey University Library staff, and

all of the invaluable secretaries and technicians who kept things ticking. Thank you to W and R Black for your kind hospitality, and to B Springett and J Holland for your wisdom at various points during this project.

Carter Holt Harvey Forests; Athol Depot; the Department of Conservation — especially S Cranwell, J Dodgson, G Foster, J Heaphy, S McManus and H Speed; Fletcher Challenge Forests; Forest and Bird Waikato; Radio Forestland; Massey University; the Pulp and Paper Analytical Lab; B Ebert; B Lloyd; O Long; J McLennan; S Merrell; P Murray; K Puklowski; A Robertson; F Rodwell; I Stringer; and T van Rooijen are thanked for generously loaning or providing access to equipment. Thank you to J Sheat for your fantastic and timely light holders.

A big thank you to B Carter of the Carter Observatory for kindly providing sunset and sunrise times and moon data; R Black, B Cuff, D Bragg, S Downs, G Hall, M Hoskings, M McLarin, and S Webb of Carter Holt Harvey Forests for forest and climate data; and D McNab of Fletcher Challenge Forests for details of Pt Horohoro Forest. Bat data was generously made available by the Department of Conservation: K Borkin, R Griffiths, J Heaphy, J Lyall, K Owen, H Speed, M Wilke; Pan Pac Forest Products: B Gilmore, M Hansen; Wildland Consultants: W Shaw; and Te Papa: C Paulin. C Preston is gratefully acknowledged for her help distributing bat sighting forms. Thank you to all whom contributed sightings.

G Arnold is thanked for his statistical advice, and M Tuohy for advice on GIS and giving me access to his lab. Authority to capture and radio-tag alive absolutely protected wildlife, under the Wildlife Act 1953, was granted by the Department of Conservation, with animal ethics approval from the Massey University Animal Ethics Committee.

Grateful acknowledgement is also made of those organisations who provided funding through the Holt Forest Trust Scholarship, Massey Scholarship, Massey Masterate Scholarship, New Zealand Federation of University Women (Inc) Manawatu Branch Scholarship, Coombs Memorial Bursary, Maxwell Ralph Jacobs Fund, Graduate Research Fund, Ecology Development Fund and Massey University Departmental Allocation. Your help has been invaluable. Forest and Bird Waikato is sincerely thanked for funding 10 radio-transmitters. Funding and support from Workbridge and DAMU have also played a significant part in the realisation of this research — thank you.

Thank you to my family for your encouragement and help throughout this project both in the field and otherwise. I'm sure the many stories of this project will live on. Finally, to those I've been unable to list here, thank you for your valued contributions.

AUTHOR'S NOTE

In the interests of clarity and ease of reading, the following chapters are structured as eight interrelated but standalone papers. While this leads to some repetition of material, it is thought that the benefits of this format far outweigh its limitations. Style decisions have been guided by the recommendations of the Council of Biological Editors. Supplementary information, including statistical analyses, is included in appendices at the back of this volume.

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