

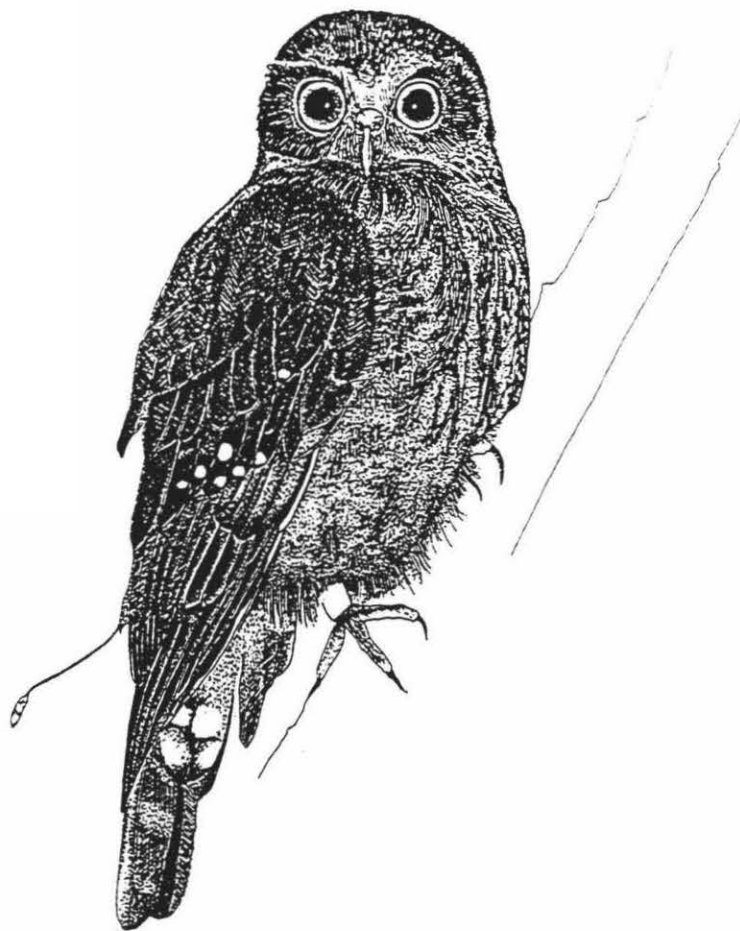
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The ecology and breeding biology of morepork, *Ninox novaeseelandiae*, and their risk from secondary poisoning,
in New Zealand

by

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A thesis

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Thesis abstract

I studied morepork, *Ninox novaeseelandiae*, on Mokoia Island from November 1995 through to March 1997. Radio telemetry was a technique essential for the study of this species. Methods for the capture of morepork and attachment of radio transmitters were developed during this study. A population estimate of 25 breeding pairs was made for Mokoia.

Thirty-one morepork were captured and transmitters were fitted to 21 of these birds. Both adults and juveniles were radio-tagged successfully. Morphological measurements, a blood sample and plumage descriptions were made at the time of capture. Using the morphological measurements and plumage characteristics the sex of the bird was, in most cases, unable to be determined. However, using the blood sample collected and a DNA based technique, sex could be resolved in all cases.

Before this study, little was known about the ecology and breeding biology of morepork. This thesis reveals that morepork are primarily nocturnal, strictly territorial, and roost during the day amongst foliage. It has also confirmed that morepork are primarily insectivorous, but do prey on mice, *Mus musculus*, and birds. Breeding occurs from September through to January, and nests were located in a variety of locations.

Secondary poisoning has received relatively little investigation, both in New Zealand and world-wide. The growing use of second-generation anticoagulant poisons in New Zealand conservation means that more information is needed. Seventeen radio-tagged morepork were monitored following a poison drop in September 1996, to eradicate mice from Mokoia. I followed 14 birds successfully, and of these, one died due to secondary poisoning, and a further two birds died, probably also as a result of poisoning.

This thesis, therefore, provides information not only on the ecology and breeding biology of a little known species, but also information of use to conservation managers planning future poisoning operations.

Thesis introduction

When looking for a Masters project midway through the final year of my BSc, I approached both Ed Minot and Doug Armstrong, hoping they might be able to help me. Doug had recently been talking with Paul Jansen, then with Department of Conservation in Rotorua, and he had suggested a project studying morepork on Mokoia Island. A mouse eradication was then being planned, and it was unknown what effect this would have on morepork, through the loss of a presumed prey source and/or through secondary poisoning.

I decided this was an interesting problem and started to research morepork and the problem of secondary poisoning. I quickly learnt that there was a dearth of information in both of these areas. Little was known about the basic biology of morepork. Secondary poisoning, while appreciated to be important, had received little research in New Zealand and worldwide. With New Zealand's position in the world-wide conservation movement, I decided that here was something that could potentially be very useful to conservation managers.

The early days of the project were quite demanding due to the fact that almost everything I wanted to do had to be figured out myself with the help of my supervisors - there was almost nothing on which to base our ideas. During the first year of the thesis I managed to meet and correspond with several other people who had studied morepork and other owls, and to these people I am very grateful. However, those first few months involved a very steep learning curve. During this project I have also been lucky enough to learn and utilise a wide range of different skills. The use of transmitters was something I wanted to master, but apart from that I have had an introduction to nocturnal field work, time budget analysis, diet analysis, the use of a home range software package, bird handling and bleeding, the use of cameras and automated set ups at nests, molecular DNA techniques, basic statistics, and hopefully scientific writing skills.

I hope that this thesis, and the scientific papers that have and will be published from it, will provide a substantial base for future study of morepork and secondary poisoning. Each chapter in this thesis has essentially been written as a stand alone scientific paper. Chapters 1, 4 and 5 and parts of 2 and 3 were included, along with management recommendations in a report to the World Wide Fund for Nature.

The contents of the chapters are as follows:

Chapter 1 *General introduction to morepork and Mokoia Island*

This chapter introduces morepork, outlines what is currently known about its ecology, and discusses its taxonomy and relationship with other *Ninox* owls. As can be seen from this chapter, not much is known about this species, and this thesis represents a major step forward. Mokoia Island, the study site at which this research was conducted, is also outlined in this chapter.

Chapter 2 *The ecology of morepork on Mokoia Island*

In this rather large chapter I outline the major methodologies used and give a brief overview of the study site. This chapter forms the basis of the ecological work that was conducted during my study and outlines the home ranges, hunting behaviour, roosting and diet information collected. I felt it was better to deal with this material in a single chapter because of its inter-related nature. However, it will be published in several parts. Some of the home range data were presented in a talk at the Ornithological Society of New Zealand's 1998 AGM in Wellington. Although much of this material is not 'traditional' thesis material, I feel it is warranted due to a lack of knowledge of this species, and it does provide the first real insight into the natural history of the species. Much of this information also forms background information to other parts of the thesis.

Chapter 3 The breeding biology of morepork on Mokoia Island

This chapter details the breeding biology of morepork on Mokoia Island. It outlines the nest sites used, describes the eggs and chicks, and presents the first information on morepork chick growth. Differences between the two breeding seasons are also discussed. This chapter will also be submitted for publication.

Chapter 4 A review of anticoagulant use with special reference to brodifacoum and secondary poisoning

This chapter reviews the problem of introduced rodents both in New Zealand and world wide. The use of anticoagulants has been seen as a major step forward in rodent control and eradication. This chapter, however, discusses some of the experiments that have been conducted and shown that the secondary poisoning of avian predators can and does occur with the use of these poisons. Some management implications are discussed in the conclusion. Material from this chapter was presented at the student session of the New Zealand Ecological Society and the Ecological Society of Australia annual meeting in Dunedin 1998. This chapter will also be submitted for publication.

Chapter 5 Potential secondary effects of the rodenticide brodifacoum on morepork

This chapter has really been the key outcome of the study. The project was designed around this chapter, and has since formed the basis of a report to the World Wide Fund for Nature. It details the survival of morepork on Mokoia following the mouse eradication attempt in September 1996. The information in this chapter was presented at both the New Zealand Ecological Society annual meeting in Wellington 1997, and the Ecological consequences of pest management meeting in Christchurch 1998. As part of this conference the material presented will be published in a special issue of the New Zealand Journal of Ecology in 1999.

Chapter 6 *Molecular sexing of morepork*

Due to the lack of sexual dimorphism of morepork I decided that a better way to sex the birds was needed. For this I turned to a recently developed molecular method for determining the sex of birds, based on DNA polymerase chain reaction. This technique worked well and is outlined in this chapter.

Appendices

Several appendices have been added to this thesis. Appendix one details climate information for the study site. Much of this information was used during the analysis stage of this project and so has been presented as background information.

Appendix two is a paper that is currently in press in the journal *Corrella* (due to be published in the December 1998 issue). This paper outlines the capture, handling, marking and radio-tagging of morepork in New Zealand, along with information added by an Australian colleague, Dr Penny Olsen.

Appendix three consists of two tables, the first detailing all birds caught on Mokoia and fitted with transmitters, and the second all birds caught and just banded. This may be helpful to the reader when the band numbers of birds are referred to in the text throughout the thesis.

Appendix four is a detailed discussion of morepork moult. This material is the first quantitative work on morepork moult, and it is discussed in relation to other small owls.

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