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The diet of the New Zealand long-tailed bat, *Chalinolobus tuberculatus*

A thesis presented in partial fulfilment of the requirements for the degree of

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"Our task must be to free ourselves from this prison by widening our circle of compassion to embrace all living creatures and the whole of nature in its beauty." – Albert Einstein

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Abstract

The long-tailed bat (*Chalinolobus tuberculatus* Forster, 1884) and the lesser short-tailed bat (*Mystacina tuberculata* Gray, 1883) are both endemic and the only extanct bat species in New Zealand (Alexander, 2001). The long-tailed bat and the short-tailed bat are considered threatened; they are listed as vulnerable on the IUCN Red List of Threatened Animals and the Department of Conservation (DOC) lists long-tailed bats as 'nationally vulnerable', and lesser short-tailed bats as 'nationally endangered' (O'Donnell, Christie, Hitchmough, Lloyd, & Parsons, 2010). Research conducted on long-tailed bats has focused on roosting choice and behaviour with limited investigation of their diet. This leaves big gaps in our knowledge and due to both species inhabiting exotic plantation forests there is also the possibility for the bats to be important insect pest control agents.

Insect fragments were identified from New Zealand long-tailed bat faecal samples collected from under known roosts and harp traps in Kinleith Forest and Pureora Forest Park in the central North Island, New Zealand. In total 2247 fragments were mounted on slides (1335 from Pureora and 912 from Kinleith) and 15% of these were unidentifiable (346). Over both study sites, Diptera made up the largest percentage of the diet with 40%, Lepidoptera comprised 24%, Coleoptera 18%, Trichoptera 0.8%, and Hymenoptera 0.36%. Whole mites or mite remains comprised 0.8% of all fragments. Eleven fragments in total were found to be from Lepidoptera larvae which contradicts previous observations of long-tailed bats not eating terrestrial, non-winged insects. There were significant differences in the diet of the bats in native forest with the bats in exotic forest, showing long-tailed bats can be flexible in regards to the environment they live in whilst maintaining a normal diet.

The diets of the same two populations of New Zealand long-tailed bat were assessed by using stable carbon ($\delta^{13}C$) and nitrogen ($\delta^{15}N$) isotope analysis of faeces. This is the first instance where stable isotope analysis has been used to investigate New Zealand bat diet. Faecal samples from a population of New Zealand long-tailed bats in a Fiordland forest and a population of New Zealand short-tailed bats from Pureora Forest Park were also analysed to use as a comparison. The $\delta^{13}C$ (‰) and $\delta^{15}N$ (‰) values of bat faeces were similar to those of Lepidoptera, Diptera, and Coleoptera implying these are the insects eaten most

often. Only minor similarities were found between the $\delta^{13}C$ (‰) and $\delta^{15}N$ (‰) values of bat faeces and those of Trichoptera, Hymenoptera, and Hemiptera implying these insects are eaten less often. New Zealand long-tailed bats in Pureora Forest and Kinleith Forest have opportunistic, generalist diets. There were no significant differences in the diet of the bats in native forest with the bats in exotic forest showing bats inhabiting exotic plantation forests can maintain a good quality diet similar to bats inhabiting native forests. There were also no significant differences in the diet of Pureora Forest long-tailed bats and short-tailed bats which is strange considering the bats occupy different niches. In this study by combining physical search of faeces and stable isotope analysis, new information on the diet of the long-tailed bat was gained. After comparison, both techniques have their merits and that, if possible, it is best to utilise both when investigating diet.

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Author's Note

The following chapters have been structured as a general introduction followed by two interrelated but standalone papers. This leads to some repetition of information.

Table of Contents

Abstract iii

Acknowledgements v

Author's Note vii

List of Figures x

List of Tables xi

1. General introduction 2

1.1. Bats 2

1.2. Bat ecology and diet 3

1.3. Methods of studying bat diet 4

1.4. New Zealand bats 6

1.5. Objectives 10

1.6. References 11

2. The use of physical search methods to identify the diet of the New Zealand long-tailed bat, *Chalinolobus tuberculatus*. 18

2.1. Abstract 18

2.2. Introduction 18

2.3. Methods 20

2.3.1. Study area 20

2.3.2. Faeces collection 22

2.3.3. Invertebrate sampling 22

2.3.4. Physical search of faeces 24

2.3.5. Data analysis 24

2.4. Results 24

2.4.1. Invertebrate sampling analyses....24
2.4.2. Bat faeces diet analyses....25
2.5. Discussion....28
2.6. References....33
3. The use of stable isotope analysis to identify the diet of the New Zealand long-tailed bat, *Chalinolobus tuberculatus*....37
3.1. Abstract....37
3.2. Introduction....37
3.3. Methods....39
3.3.1. Study area....39
3.3.2. Faeces collection....41
3.3.3. Invertebrate sampling....42
3.3.4. Stable Isotope analysis....43
3.3.5. Data analysis....44
3.4. Results....44
3.4.1. Light trap collections....44
3.4.2. Stable isotopes....46
3.5. Discussion....51
3.6. References....56

List of Figures

2. The use of physical search methods to identify the diet of the New Zealand long-tailed bat, *Chalinolobus tuberculatus*.....18

Figure 1. Map of Pureora Forest Park.....21

Figure 2. Map of Kinleith Forest.....23

Figure 3. Insects identified in Pureora Forest and Kinleith Forest light traps.....27

Figure 4. Insect fragments found in Pureora Forest and Kinleith Forest long-tailed bat faeces.....27

Figure 5. Fragments identified in long-tailed bat Faecal pellets thought to belong to Lepidoptera larvae.....30

3. The use of stable isotope analysis to identify the diet of the New Zealand long-tailed bat, *Chalinolobus tuberculatus*.....37

Figure 1. Map of Pureora Forest Park.....40

Figure 2. Map of Kinleith Forest.....43

Figure 3. δ13C (‰) and δ15N (‰) values of faeces.....47

Figure 4. Box plots comparing (a) δ13C (‰) values and (b) δ15N (‰) values of bat faeces.....49

Figure 5. δ13C (‰) and δ15N (‰) values of (a) Kinleith Forest long-tailed bat faeces and (b) Pureora Forest long-tailed bat faeces compared with insect values.....50

List of Tables

2. The use of physical search methods to identify the diet of the New Zealand long-tailed bat, *Chalinolobus tuberculatus*.....18

Table 1. Insects identified in light traps.....26

Table 2. Fragments identified from long-tailed bat faeces.....28

3. The use of stable isotope analysis to identify the diet of the New Zealand long-tailed bat, *Chalinolobus tuberculatus*.....37

Table 1. Insects identified in light traps.....45

Table 2. Summary table of results.....48