Eglinton Valley Lesser Short-Tailed Bat Monitoring Programme 2015/2016

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Cover image credit (Graham Dainty): Lesser short-tailed bat, Eglinton Valley 2016

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Summary

The population of South Island lesser short-tailed bats (*Mystacina tuberculata tuberculata*) in the Eglinton Valley is the only known viable population of this species on mainland South Island.

The Eglinton Valley is an ecologically important site as it is one of the only sites in the South Island with both species of bats: long-tailed bats (*Chalinolobus tuberculata*) and lesser short-tailed bats. It is also a stronghold for populations of mohua, kaka and kakariki. Continuous stoat control and periodic rat and possum control is in place in the valley to protect these species.

The Eglinton Valley lesser short-tailed bat monitoring programme is a long-term investment with the main aim of monitoring the population survival between years and the trends over time using mark-recapture methods analysed by Program MARK to assess the effectiveness of predator control in the valley.

An aerial 1080 operation was conducted over 10,300ha in the Eglinton Valley on the 12th December 2014 as a response to a rat plague event. This provided an opportunity to measure the effects of an aerial 1080 operation on a well marked lesser short-tailed bat population. The 2014/2015 report (DOCDM-1568082) described the monitoring of the lesser short-tailed bat population before, during and immediately after the 1080 operation (as well as the annual population survival monitoring in January 2015). This year's report describes the monitoring of the lesser short-tailed bat population one full year after the 1080 operation and the annual population survival monitoring in January 2016.

- Automatic readers and dataloggers were set up at all known occupied roosts and 1030 PIT-tagged bats were recorded.
- 771 PIT-tagged bats were recorded prior to the 1080 operation (27/11/14-12/12/14) and 764 (99.1%) of these have been recorded in the 13 months following the 1080 operation (19/12/2014- 28/2/16).
- The highest count of bats emerging from one roost tree, via video recordings, was 687 (n=17).
- A proportion of the population (253 bats) were marked with PIT-tags, bringing the total PIT-tagged to (2222). Recaptures indicate we have PIT-tagged more than 50% of the current population.
- More staff were trained as PIT- tag handlers.
- The annual "Bats and Banana splits" event was successful in advocating bat conservation to the local community.

1. Introduction

The South Island lesser short-tailed bat is ranked under the New Zealand Threat Classification System as nationally endangered (O'Donnell et. al., 2012). Both species of bats in New Zealand are vulnerable to introduced predators (rats, stoats, feral cats, possums) throughout the year; in summer when they congregate in large colonies, and during winter when they may remain inactive (in torpor) within roosts.

The Bat Recovery Group recognises the lesser short-tailed bat population in the Eglinton Valley as a priority for management, with the aim of maintaining long-term security of the population. The lesser short-tailed bat monitoring programme is a long-term project and compliments the suite of monitoring in the valley, resulting in a unique project with one of the longest histories and the broadest scope in the country. Informal monitoring began in 1997 when lesser short-tailed bats were discovered in the Eglinton Valley for the first time. Initially, the bats were monitored in an ad hoc fashion by conducting counts at roost sites using infra-red video-cameras and VHS SD card recorders to record bats as they exit their roost trees at night. Sampling effort has varied considerably from year to year, but a focused video-monitoring programme began in 2005. Video-monitoring of roost emergence is a useful monitoring tool; however it has limitations as it is almost certainly an under-estimate of the lesser short-tailed bat population and it varies considerably between years. Bats often emerge from several holes in a roost tree and frequently move roost sites. Roost exit counts are therefore not thought to be as sensitive at detecting changes in populations as mark-recapture analysis.

Mark-recapture analysis requires animals to be individually identified in order to calculate estimates of population size and survival. Mark-recapture analysis of banded long-tailed bats in the Eglinton Valley detected changes in populations that other monitoring methods (such as transects) failed to pick up (Pryde et al., 2005; Pryde et al., 2006). Forearm banding with uniquely numbered metal bands is the accepted technique for long-term marking of long-tailed bats. However, captive trials using a range of bands on lesser short-tailed bats indicated that bands caused swelling in forearm tissue and unacceptable damage to both forearm and wing (e.g. Lloyd, 1995; Sedgeley & Anderson, 2000). For this reason there was an urgent need to develop alternative marking techniques.

The lesser-short-tailed bat monitoring began in 2006 as collaboration between Dr Jane Sedgeley, Warren Simpson, Hannah Edmonds, Kate McInnes, DOC wildlife vet and wildlife health technician and Stu Cockburn, conservation electronics manager. The original aim of this study was to assess if passive integrated transponder tags (PIT-tags, transponders or micro-chips) are suitable for marking and monitoring population trends in lesser short-tailed bats in the Eglinton Valley. We decided to continue with the existing video-monitoring programme in order to evaluate the relative merits of each technique.

Initial work has led us to be confident that we have successfully pioneered the PIT-tagging procedure for lesser short-tailed bats. The focus of the project is now long-term monitoring of the population trends in relation to pest management. Five or more PIT-tagging sessions are conducted at communal roost trees throughout the month of January, to reach the required target of 200+ PIT-tagged bats per annum.

Invasive animal pests such as stoats, cats, rats and possums are controlled to protect a range of threatened native species present in the valley. Monitoring of mustelid and rodent abundance and survival of several threatened species is conducted each year. Long-tailed bats in the Eglinton Valley appear to be increasing slowly following a number of 1080 and pindone operations in bait stations aimed at controlling rats. However, because both species of bats only give birth to single young, once a year, recovery will be slow and difficult to detect in the short term, hence requiring a long-term commitment.

The size and scope of the rat control has varied over the years, and currently consists of a 100x100m bait station grid covering 4800ha of the Eglinton Valley. A pre-fed aerial 1080 operation, as part of the Battle for our Birds initiative was conducted over 10,300ha on the 12th December 2014, due to rising rat numbers in the valley. The survival of short-tailed bats through the 2014 aerial 1080 operation was a key focus of the 2014/15 monitoring season, and is discussed in detail in last season's report (Edmonds & Pryde, 2015). Analysis of data from this year's monitoring programme using mark-recapture shows an increase in survival from 2014 to 2015 which indicates that the control of rats following the mast year was successful. This supports the results from the detailed work done in the 2014/15 season.

2. Objectives

2.1 Monitoring lesser short-tailed bat annual survival

Aim

To estimate lesser short-tailed bat survival and population size in the Eglinton Valley from year to year, in relation to the current pest control regime.

Outcome measures

1. Record PIT-tagged bats via automatic readers and dataloggers at all roosts found.
2. Insert new Passive Integrated Transponder (PIT) tags into at least 200 bats.
3. Analyse population data using Program Mark to gain survival estimate between years.
4. Film and count bats emerging from roosts as a secondary monitoring method.

2.2 Complete monitoring of lesser short-tailed bat survival through an aerial 1080 operation

Aim

To obtain an updated final measurement of the Minimum Number Alive for short-tailed bats in the Eglinton Valley one week following the aerial December 2014 aerial 1080 operation and from this a final estimate for population survival through the 1080 operation.

Outcome measures

1. Analyse updated data using mark-recapture data to gain survival estimates for 1 week after the 1080 operation (December 2014) and in January/February 2015 and January/February 2016 using Program Mark.

3. Methods

3.1 Monitoring lesser short-tailed bat annual survival

1. Estimate survival between years by using mark-recapture with PIT-tagged bats and automatic data loggers at roosts.
    a. Find active roosts using radio-tagged bats (tagging more if losing track of location of active communal roosts).
    b. Follow radio tagged bats to roosts, set up antennae around roost holes, set up data loggers
    c. Monitor for a minimum of three weeks throughout January
    d. Calculate survival using mark-recapture

2. Insert new Passive Integrated Transponder (PIT) tags into at least 200 unmarked bats.
    a. Catch bats at active communal roosts, and insert PIT-tags into new unmarked bats as per Best Practise Manual for Conservation Techniques for Bats (Sedgeley et. al., 2012). Record recaptured bats. Record age, sex and reproductive status of all bats.

3. Film and count bats emerging from roosts as a secondary monitoring method.
    a. Follow radio tagged bats to roosts, set up cameras and recorders to film for 2 hours during emergence (10pm to midnight).
    b. Count all recorded emergence from videos using roost count.
    c. Compare and graph results.

3.2 Monitoring lesser short-tailed bat survival through an aerial 1080 operation

1. Estimate Minimum Number Alive and survival using mark-recapture with PIT-tagged bats and automatic data loggers at roosts (described in detail in last year's report: Edmonds & Pryde, 2015).

4. Results

4.1 Monitoring lesser short-tailed bat annual survival

Four female bats had transmitters attached to them during January 2016. Bats were tracked to three communal roost trees in the Murcott Burn/Knobs Flat area. All three of these roost trees were known roosts from previous seasons. Dataloggers and cameras were set up at all three roost trees (M36, M47 and M62), however M62 was the only roost that was consistently occupied for any extended period.

Survival analysis to date indicates the lesser short-tailed bat population in the Eglinton Valley are stable to increasing. The low survival rate in 2008 is likely to be related to the high rat numbers experienced in 2006/07. The slightly lowered survival in 2011 may reflect the increase in rats in October 2009, which were subsequently controlled. Rat numbers increased again in winter 2011 but were subsequently controlled. Survival rates for 2016 are not yet available as the analysis needs to be compared with the following year.

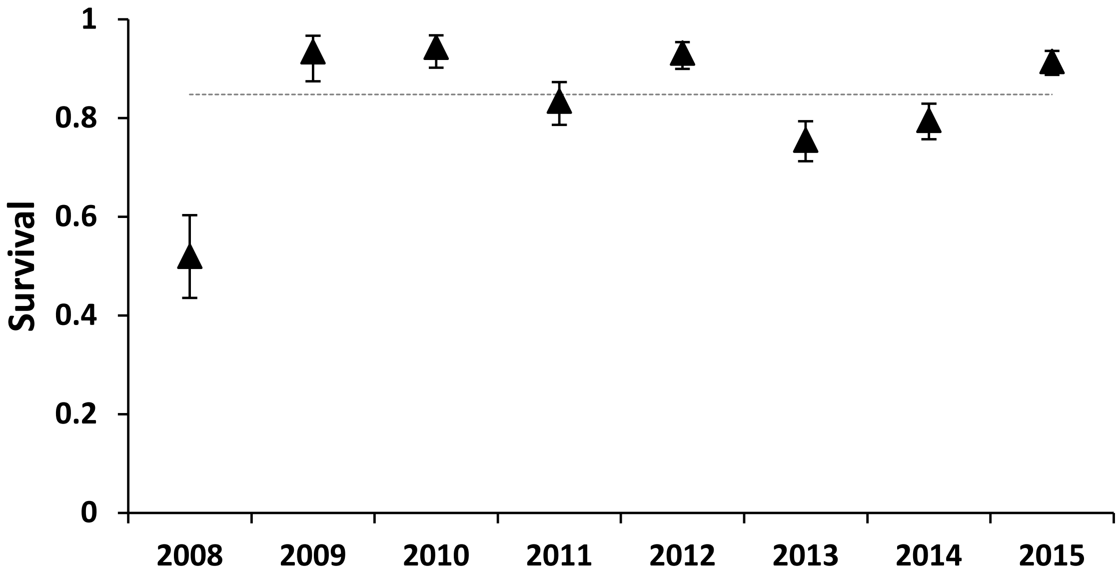

Figure 1. Annual survival of adult females with 95% confidence intervals from 2008-2015 (the grey dotted line represents the average survival rate since the project commenced).

A total of 253 new bats of a range of age, sex and reproductive classes were PIT-tagged. This brings the total number of lesser short-tailed bats tagged in the Eglinton Valley to 2222.

All previously PIT- tagged bats handled were healthy and the majority of tags were in the correct position, between the shoulder blades.

Table 1. Captures of short-tailed bats in the Eglinton Valley 2006-2016

Year	total recorded	recaps	New	AF	AM	JF	JM	unknown
2016	1030	777	253	55	14	89	95	0
2015	965	734	231	42	21	80	86	2
2014	894	648	245	110	99	13	24	0
2013	756	550	206	124	31	25	26	0
2012	831	607	224	71	35	45	71	2
2011	663	436	227	93	41	48	45	0
2010	559	309	250	91	44	56	58	1
2009	375	229	146	62	54	9	13	8
2008	239	90	149	46	49	22	26	6
2007	284	6	278	133	58	48	39	5
2006	12	0	12	5	2	4	1	0
Total pit-tagged			2222					

Emergence was recorded from two roost trees over 16 nights in January (two roosts were occupied simultaneously over one night). The largest count was 687 individual bats from one roost tree. The video counts over the years can be seen in Figure 2.

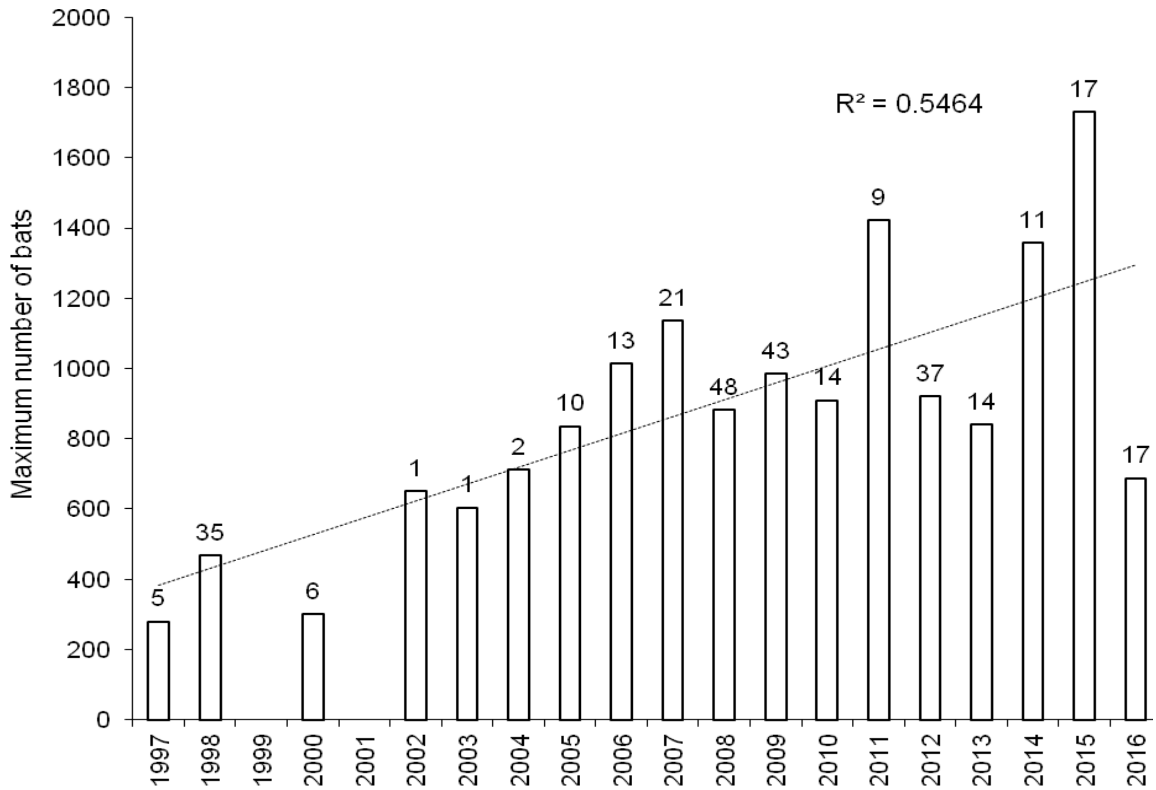

Figure 2. Graph showing maximum number of bats exiting roosts per year. Maximum number is the highest count recorded that year at either a single roost tree or the sum of roosts occupied simultaneously. The figure above each bar is the number of video counts. Note this method is an index only, it is not a true representation of the population.

4.2 Monitoring lesser short-tailed bat survival through an aerial 1080 operation

Five female bats had transmitters attached to them during November/December 2014. Bats were tracked to six communal roost trees in the Murcott Burn area, three of these roosts were previously unknown. Data loggers were set up on roost trees and registrations logged, prior to and after the 1080 operation.

771 PIT-tagged bats were recorded prior to the 1080 operation (27/11/14 to 12/12/14). 98.6% of these bats were recorded one week after the operation, and 94.4% were recorded in January 2015 (Edmonds & Pryde, 2015).

These estimates of the minimum number alive following the 1080 operation were able to be revised upwards slightly following the 2016 season due to a number of the bats which were unaccounted for being recorded during January 2016. The updated figures are presented in the table below.

Table 2. Minimum number alive (MNA) of PIT-tagged lesser short-tailed bats alive in the Eglinton Valley 2014-2016. Juveniles are defined as bats born and tagged during the previous summer (i.e. January 2014). If a bat was identified as alive in later sessions but not the second it is subsequently counted in the MNA results.

Age - sex class	November 2014 (pre 1080)	December 2014 (1 week post 1080)	January 2015 (1 month post 1080)	January 2016 (1 year post 1080)
Adult male	267	264	258	194
Adult female	449	445	441	391
Juvenile male	25	25	23	18
Juvenile female	29	29	28	26
Totals	771	764 (99.1%)	751 (97.4%)	630 (81.7%)

A detailed discussion of survival through the 2014 aerial 1080 operation was included in the 2014/15 monitoring report (Edmonds & Pryde., 2015) and will not be repeated here.

5. Discussion

Annual survival results using mark-recapture shows an increase in survival from 2014 to 2015 which indicates that the control of rats following the mast year was successful. This supports the detailed work done in the 2014/15 season following individuals throughout the 1080 operation. The monitoring of the Eglinton Valley short-tailed bat population between November 2014 and January 2016 indicates that aerially applied 1080 does not kill bats at a population level. The average survival since the PIT tagging commenced is high 0.83 when compared to other studies (Lentini et al. 2015) which suggests that the on-going management for the length of the project has been successful.

Video counts are essentially an index of the population size but are subject to huge variability related to season and behaviour. The maximum count is an indication of total population size but it relies on all the bats being in the same roost or monitoring several roosts on the same night. A low maximum count is therefore not necessarily an indication of a population decline but related to the bats being in several roosts and all roosts were not monitored in any one night. The highest video count of short-tailed bats in a single night this season (687) was lower than last season (1731) but there was only one night where two roosts were monitored. Indices are not good at measuring inter-annual variation due to the high variability. Analysis of bat transects showed that studies need to run for at least 10 years to pick up trends (O'Donnell and Langton 2003). Overall the video counts are showing an upward trend which supports the survival analysis.

6. Recommendations

We recommend the Eglinton lesser short-tailed bat project continues in its current form as a long-term project for the following reasons:

- Annual monitoring of the lesser short-tailed bat population in the Eglinton Valley is essential to test whether there are any long-term effects of 1080 and pindone poisons
- Annual marking of a proportion of the lesser short-tailed bat population is required for the mark-recapture method
- Outcome monitoring of the lesser short-tailed bats complements the suite of threatened species monitoring in the Eglinton Valley, resulting in a unique project with one of the longest histories and the broadest scope in the country
- The lesser short-tailed bat population in the Eglinton Valley is currently the only known population in existence on mainland South Island, being actively protected by pest control and studied

7. Acknowledgements

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Appendix 1. Map of lesser short-tailed bat roost trees and aerial 1080 operation area 2014