Murchison Mountains Lesser Short Tailed Bat Monitoring

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1 Summary

After preliminary monitoring in November 2019, a study into the population size and trend of lesser short-tailed bats in the Ettrick Burn commenced in 2022. A new method of mark-recapture was trialled to determine its effectiveness at providing population size and trend data with confidence. Transponder survival analysis studies give excellent long-term data but are better suited to long-term studies due to their invasive methods and slow initial data gathering. The new method worked well, with a population estimate of 323 in 2023.

2 Introduction

A new population of southern lesser short-tailed bats *(Mystacina tuberculata tuberculata)* was indicated in the Ettrick Burn, Murchison Mountains, Fiordland, using acoustic recorder data in 2018 (Jackson 2018). Before this, southern lesser short-tailed bats (STBs) were thought to remain in only two locations; Whenua Hou/Codfish Island and the Eglinton Valley, Fiordland. This was due to the extinction of other populations and left the Eglinton Valley as the only surviving mainland population.

Bats in New Zealand are vulnerable to introduced predators (rats, stoats, feral cats, possums) throughout the year (Pryde et al. 2005) and short-tailed bats are only known to have stable or increasing populations where intensive predator controls occurs, such as the Eglinton Valley, or where they are present on predator free islands, such as Whenua Hou. Stoat trapping alone has been shown to be ineffectual in protecting STB colonies and large-scale rat control is required for protection (Jackson and Pryde 2019). Limited, isolated populations make the species more vulnerable to inbreeding, disease and other stochastic events.

Short-tailed bats are extremely hard to detect due to their nocturnal nature and small size. Additionally, they spend most of their time foraging deep inside the forest and only emerge when it is well dark. This results in large gaps in the knowledge of where bats reside, and these information gaps are difficult to fill without substantial time effort and cost. The development of acoustic recorders by the Department of Conservation's (DOC) electronics team that record both NZ bat species as well as birds has made surveying far more feasible and is greatly adding to the understanding of bat distribution. There is however no project aiming to survey New Zealand comprehensively for bat presence and recordings often come from other projects with other aims.

In 2018 the Save Our Iconic Kiwi (SOIK) programme put out 160 acoustic recorders over a large area of Fiordland to monitor kiwi abundance throughout the park. These recorders were also set to record bats in the hours after kiwi data was collected resulting in over 300,000 recordings that were analysed by two individuals organised by the DOC Biodiversity Group.

One recorder located in the Ettrick Burn, picked up 9 short-tailed bat recordings in an area where short-tailed bats had not previously been recorded and 40km away from the known Eglinton population. This was followed up by the deployment of a further 111 recorders in November and December 2018 resulting in over 2000 short-tailed bat

recordings. These indicated a new population centred in the mid-Ettrick Burn in an area of predominantly red beech forest. The Murchison Mountains is a special takahe protection area with a large-scale stoat trapping network; however it has never had any form of rat control, leaving the short-tailed bat population at serious risk of decline.

3 Objectives

To estimate the population size of the Ettrick Burn colony using mark-recapture and gather information on population relatedness between the two Fiordland colonies (Ettrick and Eglinton).

4 Methods

Mist netting was undertaken the first night to catch bats for transmitter attachment. These bats were radio tracked the following day to locate occupied roost trees. Harp nets were suspended outside roost entrances to capture bats as they left during dusk. Ten mark-recapture sessions took place at roosts, with individuals being marked by trimming a small patch of fur on the back on the individual, and the age, sex, and female reproductive status recorded.

4.1 Mark-recapture

Mark-recapture was undertaken using fur clipping as a way of temporarily marking bats with the population being considered closed for the duration of the monitoring period (3 weeks). A small patch of fur was trimmed on the back using scissors and the marks were only used to identify marked vs unmarked bats (not to differentiate individual bats from each other or separating out different capture sessions). A series of marking and recapture sessions (10) took place at roost trees, where marked bats were recorded, and all unmarked individuals caught were marked, with age, sex and female reproductive status recorded. For the duration of the monitoring, unmarked bats were marked at each recapture session, continuously increasing the number of marked bats in the population following the Schnabel method for Mark-recapture.

5 Results

5.1 Mark-recapture

278 individuals were marked with age and sex ratios found in table 1 below. Captures of adult females were low during the monitoring period, while the number of juveniles and adult males was high.

					Marked					Unmarked				
					Male			Female		Male		Female		
Site	Date	Total	Marked*	Unmarked	Adult	Juvenile	Adult Nulliparous	Adult Post-Lactating	Juvenile	A	J	A NP	A PL	J
ME6	8/02/2023	2	0	2	0	0	0	0	0	1	0	0	0	1
RE8	9/02/2023	69	1	68	0	0	0	0	1	7	33	0	1	27
RE8	10/02/2023	42	1	41	1	0	0	0	0	19	4	0	14	4
RE8	11/02/2023	59	26	33	1	13	0	0	12	15	1	4	10	3
RE3	13/02/2023	72	57	15	7	26	0	0	24		7	0	1	7
RE20	14/02/2023	115	57	58	11	22	1	11	12	31	2	14	10	1
RE20	15/02/2023	32	23	9	5	9	3	0	6	7	0	0	2	0
RE20	16/02/2023	103	87	16	20	24	11	6	26	11	0	3	1	1
RE21	18/02/2023	98	83	15	32	19	2	6	24	10	0	4	1	0
RE21	20/02/2023	54	38	16	17	7	0	6	8	7	0	4	5	0
RE24	22/02/2023	16	11	5	5	1	3	1	1	4	0	1	0	0
		662	**384**	**278**	**99**	**121**	**20**	**30**	**114**	**112**	**47**	**30**	**45**	**44**

Table 1. Capture data (note ME6 is a mist net site

**Marked are bats captured that night that were found with marks from previous nights*

Population estimates were gained using the Schnabel method. They were analysed individually for each demographic class with a total population estimate of 323 (95% confidence interval (CI) 253-436).

	Pop estimate (N)	Lower 95% Confidence Interval	Upper 95% Confidence Interval
Adult male	134	109	173
Juvenile male	48	40	60
Adult NP Female	35	24	55
Adult PL Female	61	44	90
Juvenile Female	45	37	57
Total population	**323**	**253**	**436**

Table 2. Population estimates by demographic class

Analysis of all the demographic classes together gives a lower population with much narrower confidence intervals, however this is considered to be less true due to the known difference in detection probabilities between demographic classes i.e., adult females having far lower catch rates during the monitoring period.

	Pop estimate (N)	Lower 95% Confidence Interval	Upper 95% Confidence Interval
Total population	288	258	325

Table 3. Population estimates without demographic classes.

	2022	2023
Adult Male	131 (121 – 144)	134 (109 – 173)
Juvenile Male	43 (42 – 46)	48 (40 – 60)
Adult Nulliparous Female	83 (67 – 107)	35 (24 – 55)
Adult Post-lactating Female	104 (66 – 178)	61 (44 – 90)
Juvenile Female	40 (38 – 43)	45 (37 – 57)
Total Population	**401 (334 – 518)**	**323 (253 – 436)**

Table 4. Populations estimates with demographic class by monitoring year, 95% confidence intervals within brackets.

4 new roost trees were found (RE22 – RE25), with 5 roost trees occupied over the monitoring period. Roosts covered an area over 1.5km, all on the true right of the river. Roost occupancy was very short with communal roost trees being occupied on average for 2 nights.

Tree	Dates occupied	Communal/Unknown
RE8	9/2/23 / - 11/2/23	Communal
RE3	13/2/23	Communal
RE20	14/2/23 – 16/2/23	Communal
RE21	18/2/23 – 20/2/23	Communal
RE24	22/2/23	Communal

Table 5. Roost occupancy

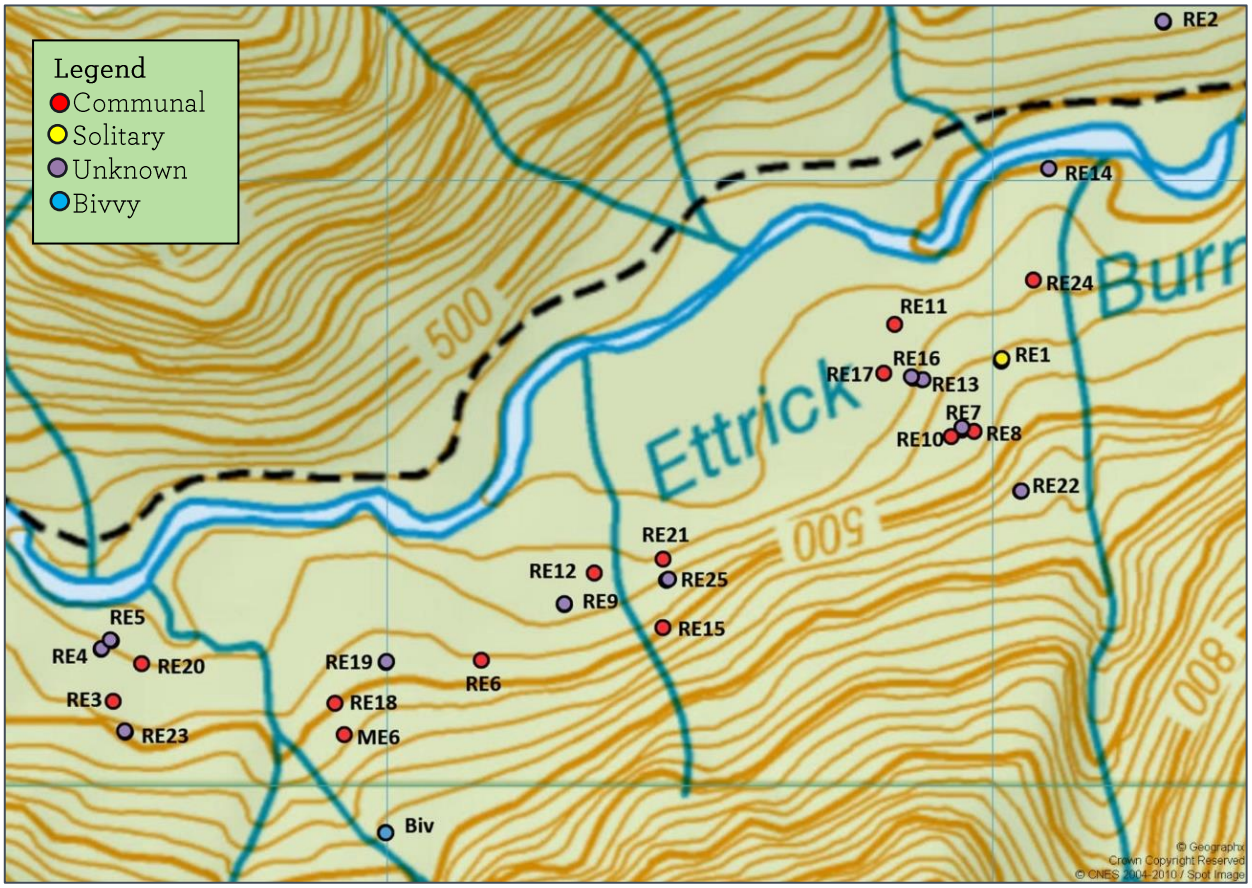

Figure 1. Short-tailed bat roost locations in the Ettrick Burn, Fiordland.

5.2 Search for Tagged Bats.

During recapture sessions all bats were scanned for PIT tags with none being detected.

6 Discussion

This was the second season of comprehensive monitoring of the population. The study began using mark-recapture and roost counts to estimate abundance. However, roost counts were not continued after the beginning of the first season as they were found to be variable and can only provide rough trends over a long study period. A five-year study is not long enough for meaningful conclusions to be drawn from this method. By not undertaking roost emergence counts, more effort was able to be put into mark-recapture. The previous year trialled a simple mark-recapture method using fur clipping to mark bats without distinguishing individuals and found it to be effective over the short monitoring period in a population of this size.

This season's population estimates are significantly lower than the 2022 season (323 vs 401). This is likely due to the lower numbers of adult females caught, which proved elusive - only accounting for 19% of all captures. This leads to inaccurate estimates in nulliparous females (N = 35, 95% CI 24 – 44) and post-lactating females (N = 61, 95% CI 44

– 90). However, comparing estimates of juveniles (93 vs 83) is a good indicator of population health, which shows that the colony is holding steady. This year's breeding season started earlier than usual, which also occurred last season. A further variation compared to 2022 can be accounted for due to the mark-recapture and data analysis method being changed this year. The previous year followed a standard capture/mark/recapture Lincoln Peterson method, with bats only being marked during the four initial marking sessions, and unmarked bats caught during subsequent six recapture sessions left unmarked. This year followed the Schnabel method of marking unmarked bats captured during each session, continuously adding to the marked proportion of the population and providing a more robust data set. This method should be used in following years to provide a consistent data set for analysis.

Using pooled analysis results in a far narrower, and lower, population estimate than using un-pooled data. However, the un-pooled analysis shows that all individuals do not have the same probability of detection, and thus it is the best method for obtaining a population estimate.

No tagged bats were found, further indicating that the population has been separate from the Eglinton population for a long time.

Several adult males caught this year had scabs on their lower jaws and brown patches on their tongues. These abnormalities have not been observed in other bats across the country, although no other projects are catching large numbers of adult males at the same time of the year. It is unknown if it is disease or behavioural related from potential male fighting.

7 Recommendations

1. Continue monitoring the population for another 3 years to form a good understanding of the population and how it is responding to pest management.
2. Instigate landscape scale rat control during the next beech masting event.
3. Undertake genetic analysis.
4. Continue with Schnabel method to provide consistent data set across monitoring periods.

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9 References

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