Bats: counting away from roosts—bat detectors on line transects

Version 1.0

This specification was prepared by Jane Sedgeley in 2012.

Contents

Department of Conservation
Te Papa Atawhai

Synopsis

Many bat species use a form of sonar known as echolocation to navigate, orientate and forage. The frequency of bat echolocation calls is generally much higher than humans can hear (ultrasonic). Bat detectors can be used to listen to these calls and are useful tools to unobtrusively survey, monitor and identify bat species. Bat calls are picked up by the detector's microphone and transformed into lower frequencies that are heard on the detector as series of clicks as a bat flies into and out of range. A series of these audible clicks is defined as a 'bat pass'. Long-tailed bats can be surveyed using hand-held bat detectors to count their calls whilst walking transects along roads, tracks or bush-edges in a particular study area (O'Donnell & Sedgeley 2001). Bat detectors should be tuned to 40 kHz to pick up calls of long-tailed bats. For more information, see 'Background to bat detectors' in the 'DOC best practice manual of conservation techniques for bats' (docdm-131465). Variations of the technique include cycling and driving (Walsh et al. 2001).

Transect surveys are standardised, with each transect being 1 km in length and taking about 20 minutes to walk. All bats seen, and all bat passes heard, are recorded. Ideally, a survey would involve at least 40–50 transects. The transect method can be used to collect presence/absence data and to examine distribution and habitat relationships. Recording the number of bat passes per transect, per hour or per survey can also provide estimates of bat activity for a specific place and time. However, this method can only provide indices, because the number of bat passes per transect does not necessarily correlate with the number of individual bats encountered. Therefore, relative abundance can only be estimated coarsely (e.g. you can conclude that bats are common, uncommon or rare).

Transect counts are excellent for rapid inventories, one-off surveys and distribution studies of long-tailed bats. Transect counts have potential for detecting long-term population trends in bats, but if bats are uncommon it will take a long time, or a large sample size, to detect population trends. For example, O'Donnell & Langton (2003) estimated that to obtain sufficient power to detect changes in the order of 3%–10% per year in long-tailed bat populations, it would be necessary to monitor 50–100 transects once per year per study area, and surveys should run for more than 10 years. Long-term monitoring trials have not been completed, so best practice has not yet been established.

The line transect method is much less suitable for lesser short-tailed bats because this species largely forages within the forest interior where it is hard to survey at night, and it has very quiet calls (see 'Disadvantages').

Bat detectors can also be used to detect and record bat calls remotely. For more details on using bat detectors automatically, see 'Bats: counting away from roosts—automatic bat detectors' (docdm-590733). There are several differences between transects and automatic methods. Stationary automatic bat detector and recording devices can sample bat activity over many hours and several nights, but they have a limited bat detection range. Multiple units are required to sample larger areas effectively. Therefore, equipment costs are often high, but fewer people are required to conduct the work compared with transect surveys. In comparison, walking of transects with hand-held detectors means a large area can be covered quickly, but the time spent at each location is relatively short. This means equipment costs are far less, but several people are required if the survey area is large.

Assumptions

- Level of bat activity (number and frequency of passes) is related to relative abundance if survey conditions are standardised (O'Donnell 2000a; O'Donnell & Sedgeley 2001):
  - High activity = bats are relatively abundant.
  - Little or no activity = bats are relatively rare/uncommon.
- All bats calling within the bat detector range are detected (for more details see 'Background to bat detectors' in the 'DOC best practice manual of conservation techniques for bats'—docdm-131465).
- All individuals are equally detectable if survey conditions are standardised (see 'Full details of technique and best practice').

Advantages

- Transect techniques have the advantage of being very cheap to run because relatively little equipment is needed and transects can be surveyed using enthusiastic volunteers.
- The transect method can be used to sample a large area and wide variety of habitats and landforms over one or a few nights.
- The method is technologically simple—there is much less to go wrong in terms of equipment failure compared with automatic systems.

Disadvantages

Transect surveys can be labour intensive, depending on the size of the area requiring coverage.

- Bat activity is greatly affected by temperature, weather conditions and season. It is almost pointless undertaking transect counts in sub-optimal conditions.
- The line transect method is less suitable for lesser short-tailed bats because this species largely forages within the forest interior and has very quiet calls. Walking along transects within dense forest in the dark can be difficult, and a bat detector set at the frequency needed to pick up lesser short-tailed bats (28 kHz) will pick up many other low-frequency sounds generated as field workers move through vegetation. Those sounds can obscure the comparatively softer-sounding bat calls.
- The number of bat passes per transect does not necessarily relate to the number of bats encountered, e.g. 10 bat passes may be made by a single bat, or they could be made by several bats. Thus, recording the number of bat passes provides an index of activity, rather than an absolute measure.
- Relative abundance can only be estimated coarsely (e.g. you can conclude that bats are common, uncommon or rare).

Suitability for inventory

- Long-tailed bats have relatively loud echolocation calls and they frequently forage along forest edges. These behaviours make long-tailed bats particularly well suited to being detected using line-transect surveys.
- Transect counts are excellent for rapid inventories, one-off surveys and distribution studies of long-tailed bats.
- Transect counts are best for answering questions like: Are long-tailed bats present in an area? How widely distributed are long-tailed bats in an area? What habitat types are long-tailed bats using in an area?
- Because of variability of detection, non-detection does not automatically imply absence.

Suitability for monitoring

- Transect counts have potential for detecting population trends in bats, but only under long-term monitoring schemes (e.g. > 15 yrs; Walsh et al. 2001).
- If bats are uncommon, it will take a long time, or a large sample size, to detect population trends. For example, O'Donnell & Langton (2003) estimated that to obtain sufficient power to detect changes in the order of 3%–10% per year in long-tailed bat populations, it would be necessary to monitor 50–100 transects once per year per study area, and surveys should run for more than 10 years.
- Current long-term monitoring trials have not been completed, so best practice has not yet been established.
- Raw data can be misleading when trying to detect trends, because environmental conditions have a huge influence on bat activity levels (O'Donnell 2000a). Raw data need to be subjected to in-depth statistical modelling to partition the variability between that resulting from environmental conditions during each survey and that attributable to changes in bat numbers.

Skills

Anyone can do bat detector line-transect surveys with minimal training.

Workers need to be able to:

- Identify bat calls from other sounds picked up on bat detectors.
- Distinguish between calls of long-tailed bats and lesser short-tailed bats. The following audio files contain examples of bat calls recorded from Batbox III detectors:
    - 'Sequence of long-tailed bat calls' (olddm-574297)
    - 'Long-tailed bat call' (docdm-284873)
    - 'Sequence of lesser short-tailed bat calls' (olddm-574301)
    - 'Lesser short-tailed bat call' (docdm-284879)

- Tune equipment or check tuning: Heterodyne bat detectors that need to be tuned (e.g. Batbox III detectors which are most commonly used by DOC) must be set to 40 kHz to pick up calls of long-tailed bats.
- Identify and quantify 'bat passes': Passes are defined as a sequence of two or more echolocation clicks and a period of silence separating one bat pass from the next (Furlonger et al. 1987).
- Work comfortably at night in the dark, and, at times, alone.
- Drive a vehicle, in order to cover large areas in one night.

Resources

This method is simple and it requires minimum equipment, specifically: GPS units, a map of the area and location of transects, bat detectors, torches, spare batteries, a thermometer, a watch, survey forms, pens/pencils, and warm clothing. Additional useful items include light-reflective vests, VHF radios and a first-aid kit.

Vehicles and several people (a minimum of two) are necessary for large-scale systematic surveys.

Minimum attributes

Consistent measurement and recording of these attributes is critical for the implementation of the method. Other attributes may be optional depending on your objective. For more information refer to 'Full details of technique and best practice'.

DOC staff must complete a 'Standard inventory and monitoring project plan' (docdm-146272).

- Name and contact details of observer
- Location
- GPS coordinates for beginning point and end point
- Date
- Start time and start temperature
- Weather conditions (and if possible, insect abundance)
- The time each bat pass is heard and the habitat type in which it was heard
- Finish time and finish temperature
- Tally of the total number of bat passes
- Tally of the total of any bats seen
- A calculation of the total time it took to walk the transect

Minimum attributes can be recorded on a standardised field sheet (Fig. 1; see 'Field sheet: line transects form'—docdm-132892). Field data can be summarised in an Excel spreadsheet.

Observer's name and contact details:				**Date:**	
Location:				**Transect reference number*:**	
GPS coordinates	Starting point:			Ending point:	
Temperature beginning:		**Temperature end:**			
Cloud cover (0 = clear, 8 = overcast):					
Weather (circle):	Fine	Showers	Drizzle	Rain	
Wind (circle):	Calm	Light	Moderate	Mod-strong	Strong
Insects (circle):	Unknown	None	Rare	Occasional	Common
BAT COUNTS					
Time start:		**Time end:**		**Total minutes:**	
Total number of bat passes heard:			**Total number of bats seen:**		
TIMES BATS HEARD & HABITAT:					

*Individual reference number is useful for transects that are repeatedly surveyed.

Figure 1. A standard recording sheet for collecting data in the field.

Data storage

Forward copies of completed survey sheets to the survey administrator, or enter data into an appropriate spreadsheet as soon as possible. Collate, consolidate and store survey information securely, also as soon as possible, and preferably immediately on return from the field. The key steps here are data entry, storage and maintenance for later analysis, followed by copying and data backup for security.

Summarise the results in a spreadsheet or equivalent. Arrange data as 'column variables', i.e. arrange data from each field on the data sheet (date, time, location, plot designation, number seen, identity, etc.) in columns, with each row representing the occasion on which a given survey plot was sampled.

If data storage is designed well at the outset, it will make the job of analysis and interpretation much easier. Before storing data, check for missing information and errors, and ensure metadata are recorded.

Storage tools can be either manual or electronic systems (or both, preferably). They will usually be summary sheets, other physical filing systems, or electronic spreadsheets and databases. Use appropriate file formats such as .xls, .txt, .dbf or specific analysis software formats. Copy and/or backup all data, whether electronic, data sheets, metadata or site access descriptions, preferably offline if the primary storage location is part of a networked system. Store the copy at a separate location for security purposes.

All bat sightings should be recorded in the DOC bat database. Figure 2 shows the data entry page from that database. Each DOC conservancy should have a separate Excel spreadsheet for this purpose. Access rights are held by the conservancy bat contact (see 'Bat Recovery Group contacts'—docdm-

132033). If a conservancy has not set up its own spreadsheet, one can be created using the 'National bat database template' (docdm-213136). See the 'Canterbury Conservancy bat database' (docdm-213179) for an example of a spreadsheet containing data.

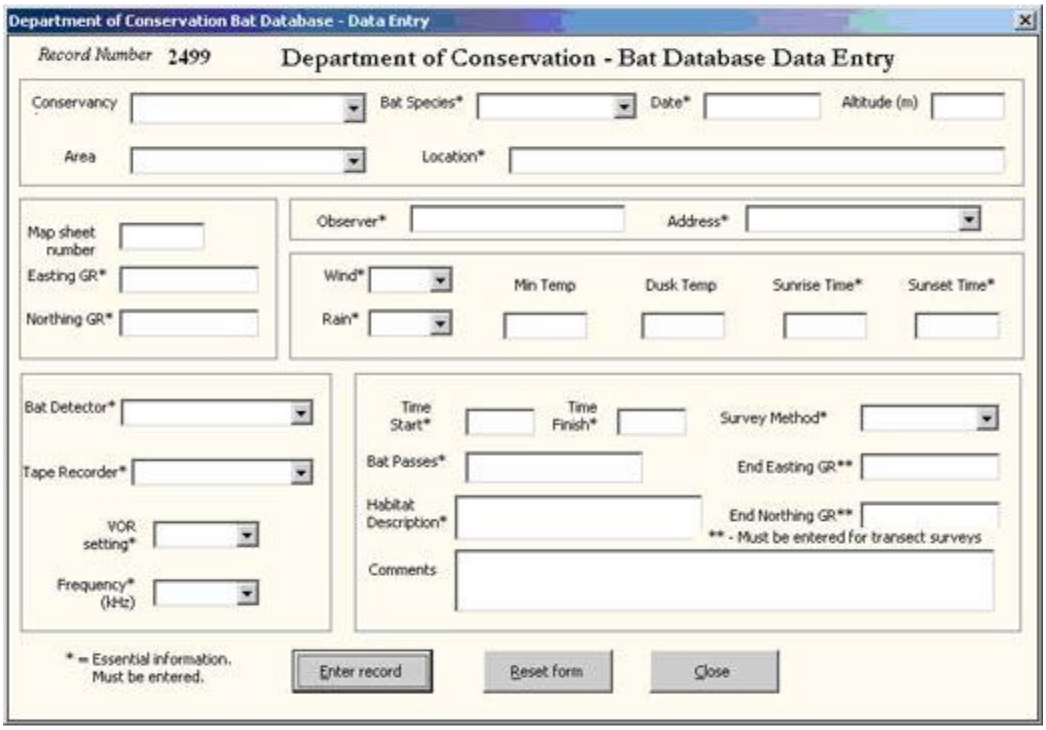

Figure 2. The data entry page from the DOC bat database.

Analysis, interpretation and reporting

Seek statistical advice from a biometrician or suitably experienced person prior to undertaking any analysis.

This method measures:

- Number of bat passes per km or per hour walked/surveyed, etc.
- Index of abundance for a specific place and time
- Distribution and habitat relationships
- Presence/absence

Results are best summarised in a spreadsheet. For an example, see Appendix 3 in O'Donnell & Sedgeley 2001. Columns in the spreadsheet should include all data recorded in the field sheet because all attributes need to be accounted for in any analysis.

Presenting results

Results can be presented in a number of ways. Distribution maps of presence/absence can be drawn (e.g. 'Case study A'; and O'Donnell 2000b) or the frequency of occurrence of bats on each survey or average number of bat passes per survey graphed (e.g. Figs 3 and 4). Simple statistics for comparison can be calculated, such as the percentage of transects on which bats were encountered, or mean number of bat passes heard per km per h. See Kelly et al. (2005) for general guidelines on designing and producing graphs.

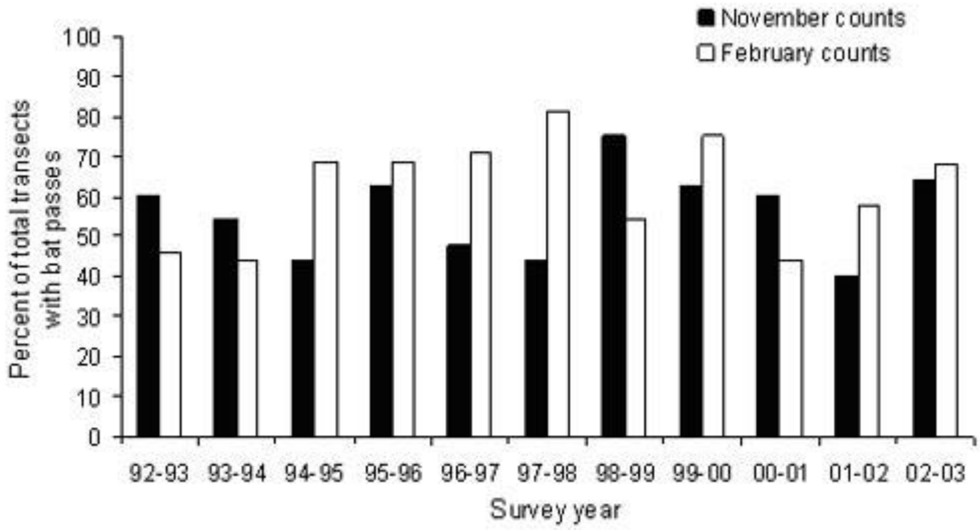

Figure 3. Example of graphed results from bat transects in the Eglinton Valley, Fiordland.

The graph shows raw counts of long-tailed bat passes obtained from 50 line transects repeated annually in November and February. Results are expressed as percentage of the total number of transects that had bat passes.

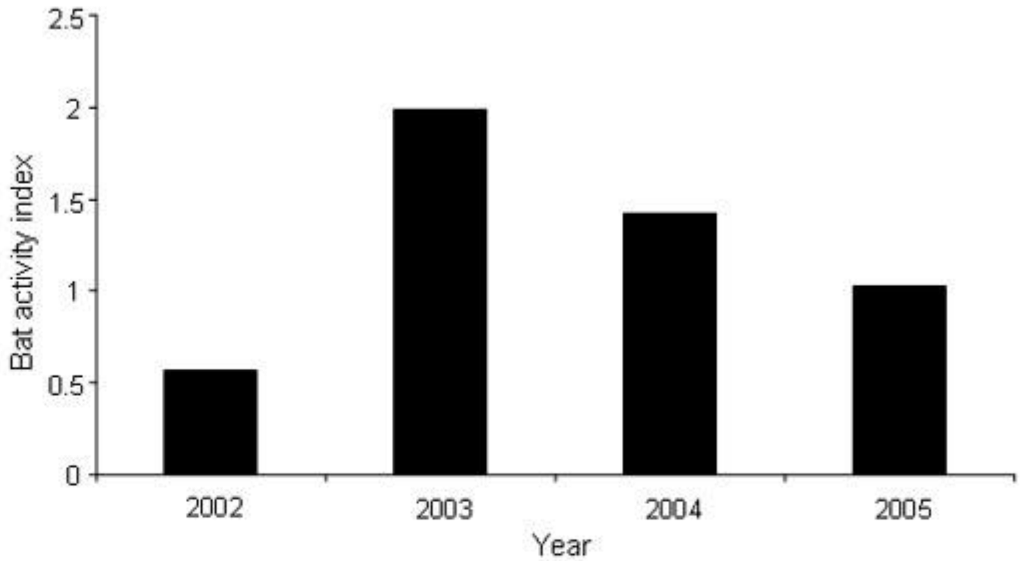

Figure 4. Example of graphed results from bat transects on Stewart Island.

The graph shows raw counts of long-tailed bat passes obtained from 51 km of transect surveys around Oban township from 2002 to 2005. Results are expressed as an activity index (number of bat passes per km) (Beavan 2006).

Analysis

In most circumstances, statistical comparisons should only be made between standardised surveys at the same site. Comparisons between sites may be misleading because surveys could have been undertaken in different conditions. Equally important is that the distribution of foraging habitats may differ between sites, resulting in bats being distributed differently in the landscape. However, if survey conditions are similar, it is possible to loosely compare sites (non-statistically) and classify them as areas with high, medium or low bat activity relative to one another.

Detailed statistical analysis of population trends requires specialist skills, and conservation managers should seek advice on the best ways to analyse counts. Data distributions for long-tailed bat counts generally show strongly skewed distributions because of a high number of zero counts. For this reason, transformations sometimes used for analysing counts of bats (e.g. Walsh & Harris 1996; Vaughan et al. 1997) are not possible. Because it is not possible to standardise all aspects of surveys between years, statistical modelling procedures are used to distinguish between variation in counts resulting from variability in environmental or sampling conditions and the actual variation in activity levels of bats between years. Analysis of deviance (Baker & Nelder 1978; O'Donnell 2000a) has been used to determine which of the significant factors best explain variation in levels of long-tailed bat activity over time.

Case study A

Case study A: using bat detectors along line transects to establish an inventory of long-tailed bats in the Eglinton Valley, Fiordland

Synopsis

The line-transect survey method was used to map presence/absence of long-tailed bats in every 1-km grid square in the Eglinton Valley, Fiordland. In 1990, DOC's database for bats contained 486 reports of bats. Of these, 36 reports were from Southland, and nine of these (25%) were from the Eglinton Valley. Sightings were from five locations spread along much of the valley length from Walker Creek in the south to Cascade Creek in the north (Figure 5A).

Objectives

The aims of the study were simple, to find out:

- How widespread were long-tailed bats in the valley
- How frequently were they encountered

- Where was the most bat activity concentrated

Sampling design and methods

A pilot study was undertaken to determine where to focus the sampling effort. The pilot study, 'Bats: counting away from roosts—visual counts' (docdm-590754) and 'Bats: counting away from roosts—automatic bat detectors' (docdm-590733) (O'Donnell & Sedgeley, 1994) indicated that most activity was along forest edges rather than forest interior and open habitats. Therefore, the best walking routes for transects through grid squares were those focused on areas of edge habitat. This approach would maximise the chance of encountering long-tailed bats. The main, more expansive, study was conducted over the period 1992–94.

The Eglinton Valley (NZ Map Series 260, D41 and D42) is approximately 50 km long. It extends from the Main Divide in the north to Lake Te Anau in the south. The aim of the study was to systematically cover all the 1-km grid squares in the valley that had accessible forest edges (Fig. 5). A walk-through survey was conducted using the line-transect method and handheld bat detectors. Sampling was repeated in different seasons, and the total number of bat passes per transect and locations of bats and adjacent habitat type were recorded.

Results

Simple distribution maps were drawn, noting grid squares in which long-tailed bats were present or absent (Fig. 5). Long-tailed bats were much more widespread in the valley and more frequently detected during the survey (Fig. 5B, 58% of 77 1-km transects) than surveyors had expected. The limited spread, low frequency, and low number of historic sightings (Fig. 5A) had implied the population was small, with a limited distribution. From the line-transect survey, long-tailed bats appeared to be abundant. A large number of bat passes were detected and sometimes more than one bat was seen at a time.

Limitations and points to consider

Although the survey indicated that long-tailed bats were common and widespread, it was not possible to extrapolate the data to an estimate of population density or population size, nor was it known where roosting sites were located.

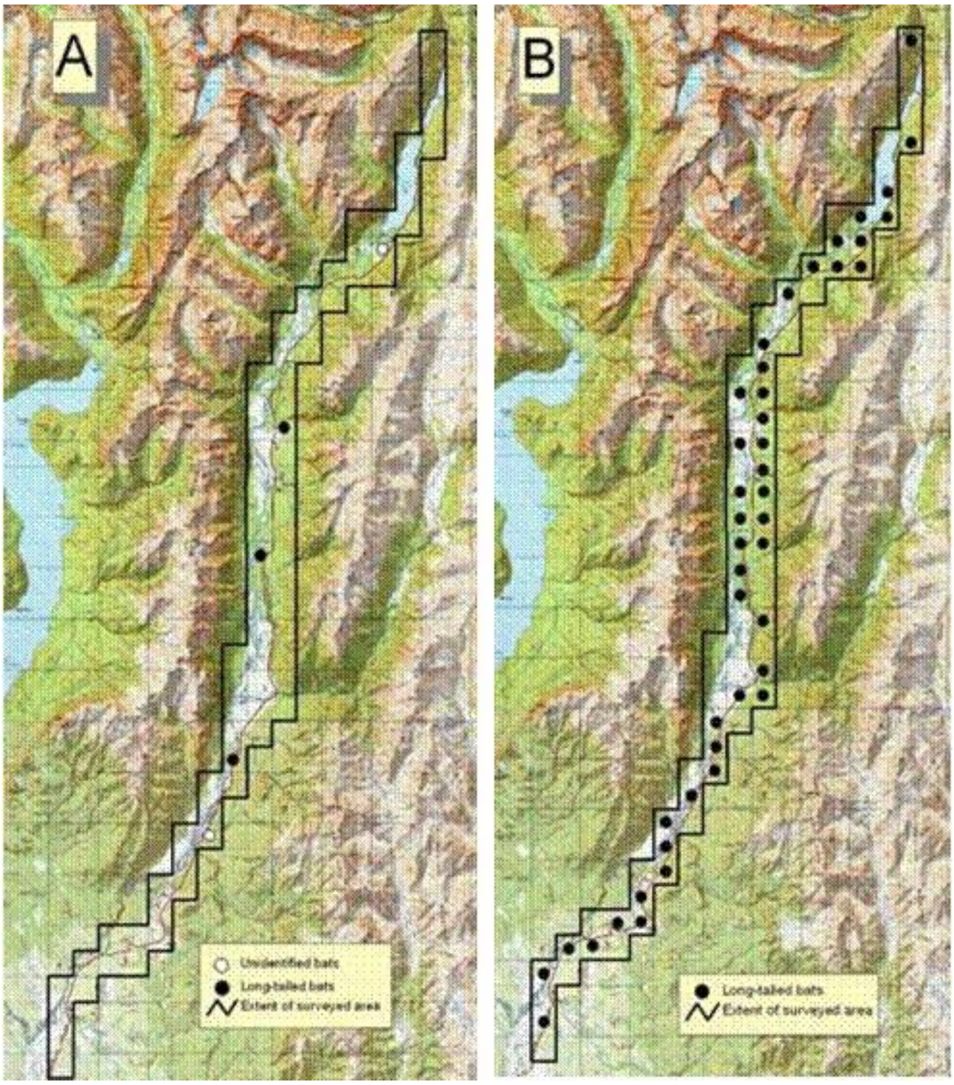

Figure 5. Distribution of bats in the Eglinton Valley mapped from (A) records of casual bat sightings from before 1990 held in the national bat database and (B) from bat detector line-transect surveys 1992–1994.

References for case study A

O'Donnell C.; Sedgeley, J. 1994: An automatic monitoring system for record*ing bat activity. Department of Conservation Technical Series No. 5*. Department of Conservation, Wellington.

Case study B

Case study B: a trial using bat detectors along line transects to monitor long-tailed bats in the Eglinton Valley, Fiordland

Synopsis

Counts of bats passes on line transects in the Eglinton Valley were repeated annually in November and February from 1992 to 2003, to assess whether line transects can be used for long-term monitoring of long-tailed bats.

Objectives

The study sought to assess the effectiveness of the line-transect method for long-term monitoring and, ultimately, to determine the status and trend of long-tailed bat populations in this valley.

Sampling design and methods

A sample of transects was conducted at different times of year in the first year of the project to determine: (a) when counts were least variable, i.e. to choose a time of year (to standardise counts), (b) the time of night and conditions when bats were most active (to maximise the chance of encountering bats), and (c) average count variability (to determine the least variable times to count bats). In addition, data on count variability were used in a power analysis to determine the sample sizes (number of transects and number of years) needed to detect a significant population trend (O'Donnell & Langton 2003).

Predictions from power analysis suggested changes to long-tailed bat populations would be detected by conducting 50 transects annually for 15 years (O'Donnell & Langton 2003).

Results

Raw count data (Fig. 3 above) and average counts (Fig. 6 below) showed no obvious trends in numbers of long-tailed bats detected on transects. Although some counts appeared to vary from year to year, analysis of deviance models indicated that differences were due to variations in weather and temperature. Once these differences were taken into account, there was no significant difference in counts from year to year (O'Donnell & Sedgeley 2001).

Limitations and points to consider

In contrast to the results derived from transect counts, other techniques for estimating changes in the long-tailed bat population in the Eglinton Valley (mark-recapture and population viability analysis) showed clear declines in the population over the same time period (Pryde et al. 2005). It is too soon to say whether transects will eventually detect these declines and be useful for long-term monitoring. These preliminary results suggest that the transect technique is either an unsuitable technique for monitoring long-tailed bats over this time frame (just over 10 years), or that monitoring has not continued for long enough to pick up a slow long-term decline (as predicted by O'Donnell & Langton 2003). However, a similar line transect survey regime in South Canterbury is showing significant declines in encounter rates over a similar time period (C. O'Donnell, unpubl. data). There, the population of long-tailed bats is much smaller and is declining at a greater rate (derived mark-recapture analysis, Pryde et al. 2006). Therefore, the sensitivity of the technique may depend on the starting population size and rate of decline.

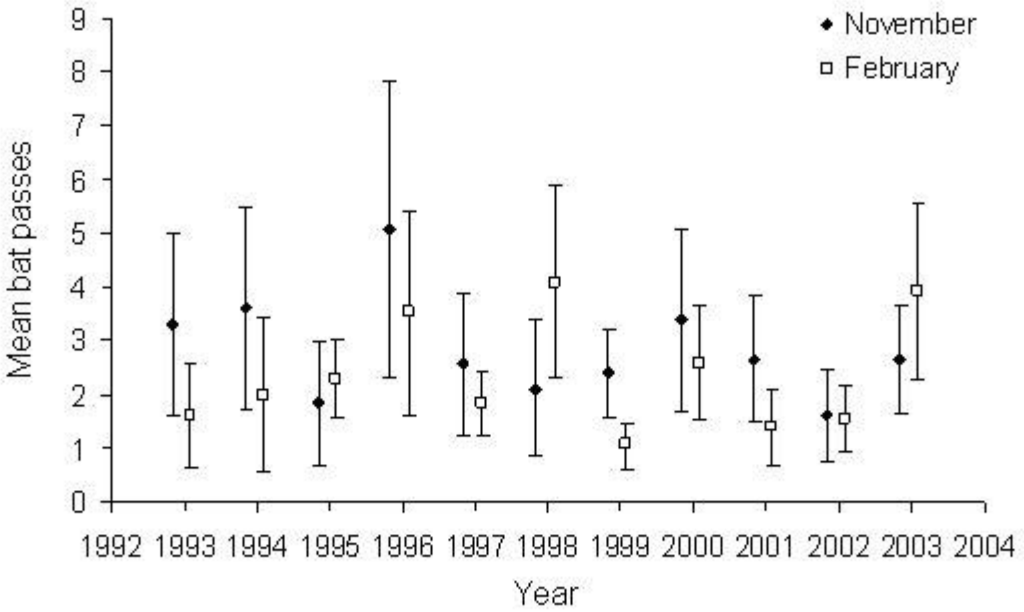

Figure 6. Average counts of long-tailed bats on 50 line transects repeated annually in November and February, Eglinton Valley, Fiordland. Results are expressed as mean number of bat passes (± 95% confidence interval) per transect.

References for case study B

O'Donnell, C.F.J.; Langton, S. 2003: Power to detect trends in abundance of long-tailed bats (*Chalinolobus tuberculatus*) using counts on line transects. *Science for Conservation 224*. Department of Conservation, Wellington.

O'Donnell, C.F.J.; Sedgeley, J.A. 2001: Guidelines for surveying and monitoring long-tailed bat populations using line transects. *Department of Conservation Science Internal Series 12*. Department of Conservation, Wellington.

Pryde, M.A.; Lettink, M.; O'Donnell, C.F.J. 2006: Survivorship in two populations of long-tailed bats (*Chalinolobus tuberculatus*) in New Zealand. *New Zealand Journal of Zoology 33*: 85–95.

Pryde, M.A.; O'Donnell, C.F.J.; Barker, R.J. 2005: Factors influencing survival and long-term population viability of New Zealand long-tailed bats (*Chalinolobus tuberculatus*): implications for conservation. *Biological Conservation 126*: 175–185.

Full details of technique and best practice

O'Donnell & Sedgeley (2001) provide full details for this method. The sections below summarise key points from that report.

Where to start

Inventory work usually focuses on places that contain suitable areas of foraging habitat, or places where there are anecdotal reports of bats (see, for example, Barrie 1995; Borkin 1999; O'Donnell 2000b). Information on habitats where bats have been found can be used to predict where bats might be found and to focus survey effort (e.g. Greaves et al. 2006).

Before commencing the counts, set up a base map of the survey area and locations of transects. It is most practical, and safest, to run transects along roads or tracks in a study area. The survey organiser should assess how many people are available and work out how to subdivide the survey into manageable sections. If transects are being surveyed for the first time, the start and end points of each transect should be recorded using a GPS. Each transect can then be individually identified by allocating a simple reference number.

How to cover an area effectively

The best way to undertake a survey is by encouraging large groups to participate over 1 or 2 nights. The most efficient approach is for people to work in pairs, with a vehicle, with each pair aiming to survey around 10 transects per night within the first 2 hours after sunset. Each transect takes about 20 minutes to walk (walking speed = c. 3 km/hr), so 50 km of transects can be surveyed in one 2–3 hour evening session.

The survey is best carried out using a 'leap-frogging' technique. The driver drops Observer 1 at the beginning of the first transect in the section. The starting point is drawn on the base map. Observer 1 begins walking the first transect. The driver zeroes the odometer and drives 1 km along the road to the start of the second transect (also the end of the first transect). The driver parks the vehicle, gets out and begins the second transect (becoming Observer 2). Meanwhile, Observer 1 completes the first transect and reaches the parked vehicle. Observer 1 then drives 1 km along the road, usually passing Observer 2. The driver can call out the odometer reading as a check for the person still walking. After 1 km, Observer 1 parks the vehicle and begins transect three, and so on. The two observers continue leap-frogging past each other using the vehicle until the required number of transects have been completed. See O'Donnell & Sedgeley (2001) for further details.

Bat passes and examples of calls

Echolocation, also called biosonar, is the biological sonar used by several mammals such as dolphins, shrews, most bats, and most whales. The term was coined by Donald Griffin, who was the first to conclusively demonstrate its existence in bats (Griffin 1958). Many bat species use echolocation to navigate, orientate and forage, often in total darkness. Bats generate high frequency sound via the larynx and emit rapid ultrasonic pulses through their mouths, or less commonly their noses. By comparing pulses with the information contained in the returning signals (echoes) are able to locate, 'range' and identify objects, including prey. Individual bat species echolocate within specific frequency ranges that suit their environment and prey types. Echolocation calls provide an opportunity to unobtrusively survey, monitor and identify bat species (Catto 1994; deOliveira 1998; Russ 1999).

The frequency of bat echolocation calls is generally much higher than humans can hear (ultrasonic). Ultrasound detectors, or bat detectors as they are commonly called, can be used to listen to bat echolocation calls and are useful tools studying bats. Bat calls are picked up by the detector's microphone and transformed into lower frequencies that humans can hear. Bat calls are heard on the detector as series of clicks as a bat flies into range. A series of these audible clicks is defined as a 'bat pass'. Passes are defined as a sequence of two or more echolocation clicks and a period of silence separating one bat pass from the next.

The following audio files contain examples of bat calls obtained using Batbox III detectors (the standard bat detector used by DOC):

- 'Sequence of long-tailed bat calls' (olddm-574297) contains a total of six long bat passes. The bat sometimes sounds like it is going away and then returning towards the microphone. This recording was made using an automatic system with a bat detector linked to a voice-activated tape recorder. The hissing noise is the sound of the tape recorder switching on and off between events.
- 'Long-tailed bat call' (docdm-284873) was recorded onto an SD card.
- 'Sequence of lesser short-tailed bat calls' (olddm-574301) contains seven bat passes. These are of shorter duration and have a faster pulse repetition rate compared with the long-tailed bat calls.
- 'Lesser short-tailed bat call' (docdm-284879) was recorded onto an SD card.

The line-transect method is much less suitable for lesser short-tailed bats because this species largely forages within the forest interior and has very quiet calls. Walking along transects within dense forest in the dark can be difficult, and a bat detector set at the frequency needed to pick up lesser short-tailed bats (28 kHz) will pick up many other sounds generated as field workers move through vegetation. Those sounds can obscure the comparatively softer-sounding bat calls.

The dials on bat detectors must be set to 40 kHz to record long-tailed bats and 28 kHz to record lesser short-tailed bats. See 'Background to bat detectors' in the 'DOC best practice manual of conservation techniques for bats' (docdm-131465) for more information on bat calls and how to distinguish between sounds on the bat detector.

Best practice for inventory of long-tailed bats on line transects

The line transect method has been standardised nationally. The manual, written by O'Donnell & Sedgeley (2001), sets out best practice. Below is a summary of key points, some of which are essential, some strongly recommended:

- A minimum of 40–50 different transects should be undertaken in an area that has been selected to sample a representative range of habitats and landforms present.
- Surveys must only be undertaken on fine, relatively warm nights with dusk temperatures ≥ 7°C.
- Transects must commence 30 minutes after sunset and continue for the next 2–3 hours, as this period coincides with peak activity in long-tailed bats. Bat activity decreases significantly after this time.
- A specific survey should last no longer than 2 weeks to avoid changes in the conspicuousness of bats.
- To examine long-term trends or changes in bat populations, surveys must be undertaken at the same time of year for each site, preferably October to February, when long-tailed bats are most conspicuous.
- Winter surveys should be avoided.

References and further reading

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Appendix A

The following Department of Conservation documents are referred to in this method:

docdm-132033	Bat Recovery Group contacts
docdm-590733	Bats: counting away from roosts—automatic bat detectors
docdm-590754	Bats: counting away from roosts—visual counts
docdm-213179	Canterbury Conservancy bat database
docdm-131465	DOC best practice manual of conservation techniques for bats
docdm-132892	Field sheet: line transects form
docdm-284879	Lesser short-tailed bat call
docdm-284873	Long-tailed bat call
docdm-213136	National bat database template
olddm-574301	Sequence of lesser short-tailed bat calls
olddm-574297	Sequence of long-tailed bat calls
docdm-146272	Standard inventory and monitoring project plan