Foraging flights of the Southern Bent-wing Bat during two seasons

GPS tracking of the Portland subpopulation in spring and summer-autumn

March 2025

Key Messages

- Southern Bent-wing Bats use multiple habitats across the landscape such as coastal scrub, forest and farmland
- Bats fly further and forage over a larger area in summer-autumn than in spring
- Individuals can commute up to approximately 150 km between roosts in a single night

Understanding seasonal movement patterns across the landscape is critical for targeting management and recovery actions for small bats that fly huge distances.

Background

The Southern Bent-wing Bat (*Miniopterus orianae bassanii*) is a small (15–20 g) Critically Endangered insectivorous microbat that is distributed in south-west Victoria and south-east South Australia. It roosts and breeds in a small number of maternity and non-breeding caves across its range, and individuals fly out from these roosts each evening to forage throughout the night. There are just three maternity caves used by this species across its entire range, and these are near Naracoorte (South Australia), Portland and Warrnambool, representing three broad subpopulations.

Bats from the Portland subpopulation that this study focussed on breed in a single maternity roost and use several non-breeding roosts nearby. It was unknown whether this subpopulation was using non-breeding roosts farther afield near Hamilton and Lower Glenelg National Park. It was also not known where individuals from the Portland subpopulation went to forage, and whether foraging habitats and locations differed throughout the year, given the varying insect availability and changing energy requirements of the bats.

During summer the females give birth to a single pup, returning to the maternity roost to feed them milk until they become independent. During the colder months, when fewer insects are available, the bats can intermittently enter torpor (lower heart rate and metabolism) to conserve energy. The females are pregnant in spring when conditions are warming, and insects are becoming more abundant. These different life stages and changing insect availability may lead to changes in foraging strategies throughout the year. We focused our project on spring when bats are likely to be increasing their activity as daytime temperatures are also increasing (but are still relatively mild), and nights are cool, and in summer-autumn when pups are independent and insect abundance should be higher due to the warmer temperatures.

Project Aims

- To GPS track individuals of the Portland subpopulation of the Southern Bent-wing Bat during two seasons to investigate foraging patterns.
- To determine if flight distances and habitat use varies between the spring, and summer-autumn periods.
- To establish whether individuals from the Portland subpopulation use non-breeding roosts in caves near Hamilton and the Lower Glenelg National Park, their general flight routes and areas of higher bat activity in the landscape.

Survey Methods

We fitted miniature combined VHF transmitters and GPS trackers to adult bats of the Portland subpopulation in September 2023 (spring, 39 individuals) and February 2024 (summer-autumn, 69 individuals) to investigate where individuals were foraging. These small units (~1.4 g combined weight) store recorded locations onboard and needed to be retrieved to access the data they contained. The VHF transmitters emit distinct high-frequency signals over 100 – 200 m to assist with locating the combined units after they have fallen off the bats. We also installed remote automated VHF receivers at non-breeding caves throughout the region to provide information on the roosting locations of the bats and to assist with retrieval of the VHF/GPS units. The GPS units recorded locations at either hourly (both seasons) or one-minute intervals (summer-autumn only), to investigate flights over multiple nights or fine-scale movements within a single night. Additionally, we trialled a non-commercial GPS tracker; these were purchased as assembled printed circuit boards that required programming, battery installation and waterproofing. Due to their different componentry, they could not be combined with a VHF transmitter and needed to be found visually. These units can collect location information at a much higher frequency (e.g. 1 second) but only for several hours within a single night. The one-second and one-minute sampling frequency data is displayed in the figures, but is not incorporated into the reported flight distances because they only represent movements over part of a night.

Results

Foraging Habitat

We retrieved 18 GPS/VHF units in spring and 29 in summer-autumn. Units took between one and 241 valid location fixes per bat. The variation in sample number was due to differing attachment times, sampling frequency and battery capability. Southern Bent-wing Bats were recorded at most habitats across the landscape (Figure 1 and Figure 2) including eucalypt and pine forest, roadsides, native and planted windbreaks, coastal scrub dominated by areas of Coast Wattle, heathland, agricultural land, a lake, beach and a suburb of Portland. In addition, we successfully deployed the non-commercial GPS units and retrieved nine functional units for data download. The non-commercial and one-minute interval samples in summer-autumn showed detailed movements along roadsides with established eucalypts, coastal scrub dominated by Coast Wattle, heathland, across native forests, pine plantations and open farmland.

Figure 1. Southern Bent-wing Bat location fixes (both hourly and one minute-interval) for both seasons at Cape Nelson, showing bat activity in coastal scrub, heathland and farmland (green points).
The red points indicate less accurate location fixes due to contact with fewer satellites.

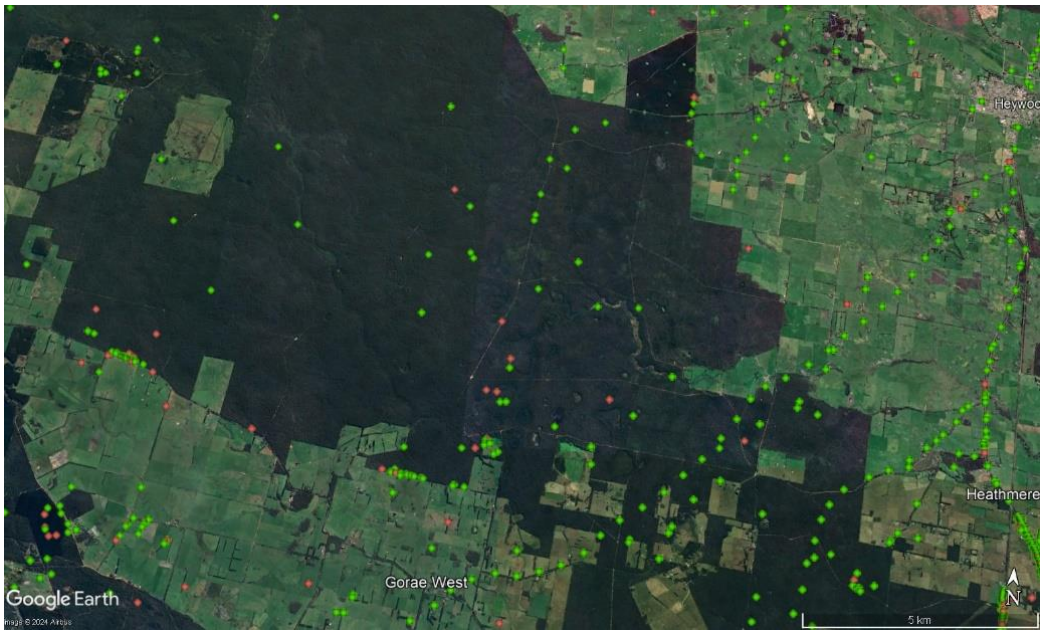

Figure 2. Southern Bent-wing Bat location fixes (both hourly and one minute-interval) for both seasons in and near Cobboboonee National Park, showing bat activity in forest and farmland (green points).
The red points indicate less accurate location fixes due to contact with fewer satellites

Flight Distances and Habitat Use in Different Seasons

The bats generally flew farther from roosts in summer-autumn than in spring, when they tended to focus their foraging efforts more locally (Table 1 and Figure 3), with the exception of one individual in spring that travelled more than 78 km straight-line distance to the east, before the unit failed. The total distance this individual flew from its previous day roost is unknown due to the unit failure. In summer-autumn a few bats flew to the Naracoorte (n=3) and Warrnambool (n=3) maternity roosts (approximately 156 km and 97 km straight-line distances respectively) in a single night, mostly returning in subsequent nights via a second direct, single-night flight. Our remote VHF units detected bats with VHF/GPS units regularly at a cave near Hamilton and one within the Lower Glenelg National Park, but we were unable to retrieve any units from bats roosting in the Lower Glenelg National Park. We also collected units from a cave in the lower southeast of South Australia, indicating some bat flights between Portland and this area.

Most of the bat activity, and all the activity from bats roosting in the Portland region on consecutive nights was recorded in an approximately 24 x 26 km area in spring and 85 x 74 km area in summer. Activity in the spring study period focused more around coastal areas, whereas during the summer-autumn study period bats were recorded foraging further inland and moving more frequently through the larger areas of forests and farmland.

Table 1. Approximate direct furthest straight-line nightly distance of bats from their roost of the previous day across all individuals with an hourly tracking interval.
On some occasions when a bat shifted to a different roost at the end of the night's foraging, the point of the maximum distance from the previous day roost is also the point closest to the next day's roost. As the exact day roost was not always known in the Portland area, due to the sampling rate of the transmitters, an averaged location has been used to determine indicative flight distances.

Season	Average (km)	Maximum (km)
Spring	11.6	78.2
Summer-Autumn	35.7	143.1

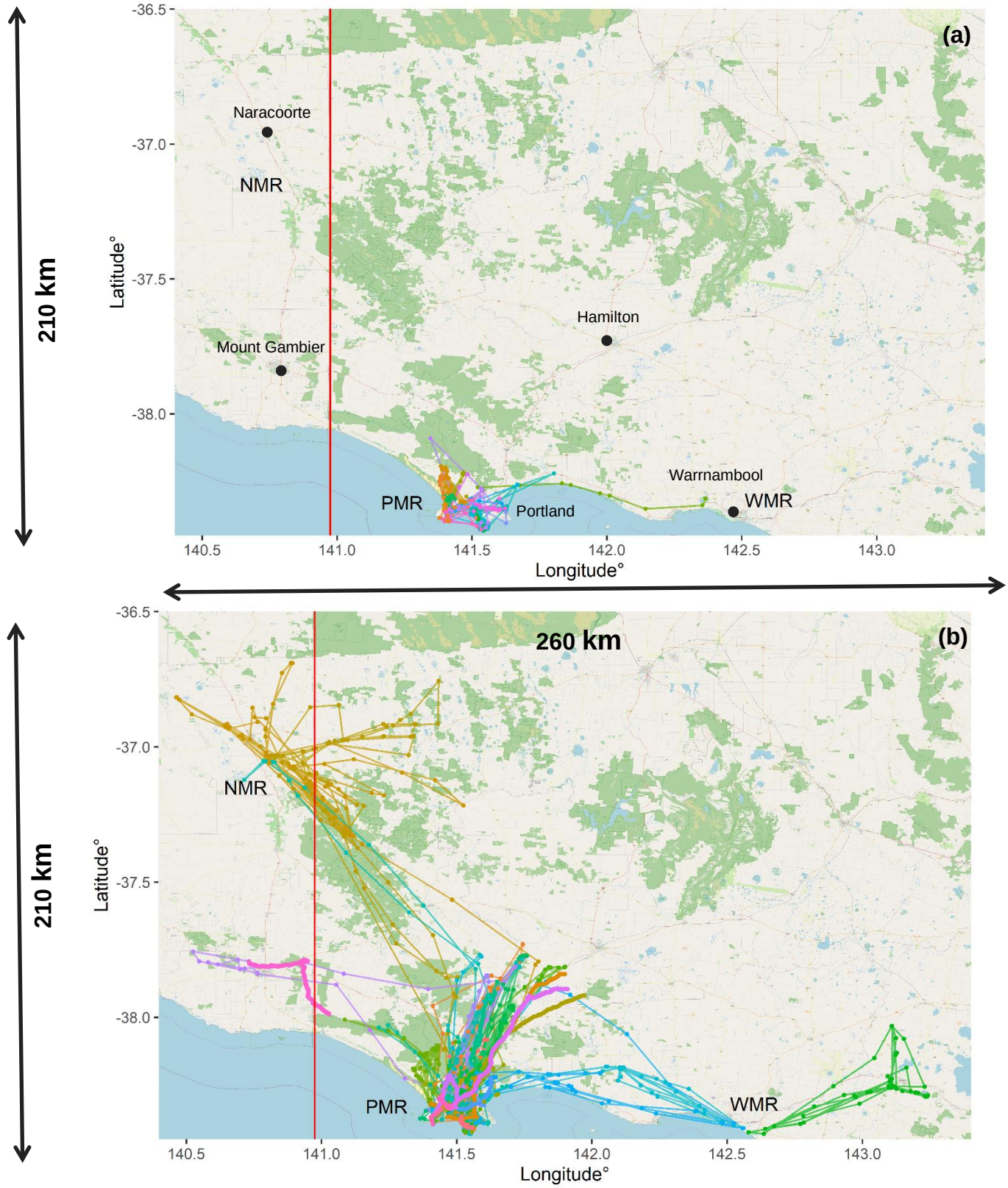

Figure 3. Tracked Southern Bent-wing Bat flights in (a) spring and (b) summer-autumn, coloured by individual. The spring tracking includes 18 individuals with hourly sampling frequency for between several hours and 11 nights. The summer-autumn tracking includes 38 individuals with second, minute and hourly frequency for between several hours and 19 nights. All trackers were fitted in the Portland area. Dots represent GPS fix locations; lines are direct routes between these but not necessarily indicative of the actual of bat flight path. The Victorian-South Australian border is represented by the vertical red line. PMR = Portland maternity roost, WMR = Warrnambool maternity roost, NMR = Naracoorte maternity roost.

Conclusions

This project has shown that the Portland subpopulation of the Southern Bent-wing Bat uses the landscape differently throughout their annual life cycle. The shorter flight distances and more localised movements we recorded over a three-week period in spring indicate that habitat close to bat roosts is very important for foraging at that time of the year. Any future habitat conservation and restoration efforts for the Portland subpopulation could target these areas.

The Southern Bent-wing Bat can fly long distances in a single night and long distances from their previous day roost, particularly in summer-autumn, but also at times during spring. A few individuals (six of 47 tracked with GPS/VHF units) flew from roosts in the Portland area to either the Naracoorte or Warrnambool maternity roosts during the longer recorded flights, with most also being tracked on return flights before GPS units stopped recording data. We had expected that there might be some flights between the maternity roosts of the different subpopulations, based on the recapture locations of bats banded in the past, but this had not been recorded in previous GPS tracking studies in summer-autumn in the other subpopulations. This project has revealed some of the flight routes that bats are taking from Portland to these roosts. Most tracked bats foraged from- and returned to-roosts each night in the Portland and Hamilton area.

Unfortunately, we did not retrieve any units from bats roosting in the Lower Glenelg National Park so have no information on where these bats were going to forage or what flight routes they took between Portland and this area. Individual bats appear to focus most foraging trips around a single maternity roost and its associated non-maternity roosts, visiting the other maternity roost subpopulation areas only briefly.

Acknowledgements

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Banner Photo: Farming landscape used by the Southern Bent-wing Bat (Amanda Bush). Southern Bent-wing Bat flying with attached VHF/GPS tracking unit (Dennis Matthews).

We acknowledge Victorian Traditional Owners and their Elders past and present as the original custodians of Victoria's land and waters and commit to genuinely partnering with them and Victoria's Aboriginal community to progress their aspirations.

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