Southern Bent-wing Bat
National Recovery Team
Annual Progress Report 2024

'Coordinating national conservation of the Southern Bent-wing Bat'

Encompassing Progress Achieved from December 2023 to November 2024

Acknowledgements

The format of this progress report has been adapted from the *Recovery team annual progress report (draft)*, Commonwealth of Australia 2017.

Cover image: A Southern Bent-wing Bat in flight with a GPS tracker attached. Courtesy of Dennis Matthews, 2024.

List of abbreviations

ARI	Arthur Rylah Institute for Environmental Research, DEECA
DAFF	Department of Agriculture, Fisheries and Forestry (Previously DAWE)
DEECA	Department of Energy, Environment and Climate Action, Victoria (Previously DELWP)
DELWP	Department of Environment, Land, Water and Planning, Victoria
DEW	Department for Environment and Water, South Australia
EPBC Act	Commonwealth Environment Protection and Biodiversity Act 1999
GHCMA	Glenelg Hopkins Catchment Management Authority
LCLB	Limestone Coast Landscape Board, South Australia
NGT	Nature Glenelg Trust
NPWS	National Parks and Wildlife Service, South Australia
PIT	Passive Integrated Transponders
SBWB	Southern Bent-wing Bat
SWIFFT	State Wide Integrated Flora and Fauna Teams, Victoria
WHA	Wildlife Health Australia
WNS	White-nose Syndrome

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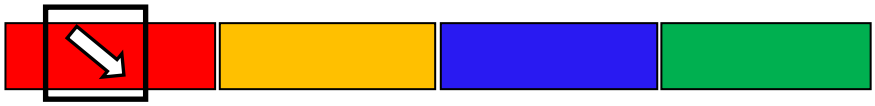
1. SUMMARY ASSESSMENT OF PROGRESS

EPBC Act Status	Critically Endangered
Recovery Plan	DELWP 2020, available at: http://www.environment.gov.au/system/files/resources/8e34a419-3e71-4321-9a8b-45c25c4320bb/files/recovery-plan-southern-bent-wing-bat.pdf
Recovery Team	Southern Bent-wing Bat National Recovery Team Chair: Dr Lindy Lumsden Lindy.Lumsden@deeca.vic.gov.au
Date of report	May 2025. Encompassing progress from December 2023 to November 2024.

State/condition and conservation trajectory



very poor **poor** **good** **very good**

Confidence Adequate. High-quality evidence and high level of consensus.

Key highlights

- The Biosecurity and Surveillance Subgroup has been working to protect SBWB from the potential introduction of White-nose Syndrome (WNS) and raising awareness regarding this threat. The subgroup has been very active in the last year, meeting multiple times, developing and updating guidelines, procedure and policy, planning monitoring activities, and expanding in membership.
- The Limestone Coast Landscape Board received funding for conservation of Southern Bent-wing Bats (SBWB) through the Australian Government's Natural Heritage Trust. Funding will be used to improve the management of foraging and roosting habitat for Southern Bent-wing Bats, with the Recovery Team advising on the project.
- Remote population monitoring is continuing with great success at the Naracoorte maternity cave, and the NHT funding should allow for improvements to this system.
- Over the 2023/24 breeding season, there was a mass mortality event of pups at the Warrnambool maternity site, with 780 dead pups found in December 2023. This will have had a significant impact on this population's recruitment for the 2023/24 season. The cause of the deaths could not be identified.
- The Victorian government has committed to the development of policy, guidance and research to better manage bird and bat impacts at Victorian wind farms. The SBWB is a priority species for this work, and the Recovery Team was included in stakeholder consultations.
- Permanent infra-red cameras are being installed at the Warrnambool maternity site. These cameras will allow for population monitoring of both adults and pups, with reduced disturbance to the bats, as well as further monitoring of illegal visitations to the cave.
- Recovery Team members continue to raise awareness of SBWB and discourage behaviours by the public which pose harm to the bats.
- SBWBs PIT-tagged in Naracoorte have been detected in Victoria, at caves associated with both Victorian subpopulations, in multiple seasons.

2. IMPLEMENTING RECOVERY ACTIONS AND MEETING OBJECTIVES

Progress towards the implementation of recovery actions and objectives in the National Recovery Plan (DELWP 2020) is outlined in the table below. New activities and progress since the last annual report in November 2023 have been summarised. A brief outline of previous work has also been included to provide context for recent progress when required. Full descriptions of progress on each action to date can be found in previous annual reports. Note that the listed actions have been abbreviated in the table. Full descriptions of each action can be found in the National Recovery Plan.

Status of the actions and objectives have been summarised using a traffic light system as follows:

🔴	**No/little progress**	No/little progress has been made on this action and/or objective not achieved
🟠	**Some progress**	Some progress has been made on this action and/or objective partly achieved
🟢	**Completed**	This action has been completed and/or objective achieved

Progress against the objectives, actions and management practices outlined in the Draft National Recovery Plan		**Status**
Objective 1. Develop techniques to accurately estimate the population size at the maternity sites and undertake regular assessments of population numbers to thoroughly document population trends.		🟠
Action 1.1 Develop techniques to estimate population numbers, survival rates & breeding success	The Naracoorte maternity cavepopulation monitoring program continued from November 2023 to November 2024 with continuing refinement of *N2,* a semi-automated bat counting program. Population estimates are calculated most days. Comparisons are being undertaken between ultrasound data assessing pregnancy rates and N2 flyout data to investigate how accurately trends in reproductive success can be predicted from N2 counts, based on results of ultrasonography (no. of weaned young). Infrared cameras are being installed in the Warrnambool maternity site, both within the main roosting chambers and at the entrance. Testing will be undertaken to determine if the flyouts are suitable for semi-automated nightly counting, and compared with the existing counting technique to obtain population estimates. The remotely accessed cameras within the roosting chambers will enable photos to be taken of clusters of roosting adults and pups, and may enable estimates of pup numbers without entry to the cave.	🟠
Action 1.2 Assess population numbers & trends	Nightly population numbers are being estimated at Naracoorte using the N2 system. In August and early September numbers fluctuated indicating bats were coming and going from Naracoorte maternity cave, as occurred in previous years. In 2024 however, large numbers returned earlier compared to the previous two years, and this year	🟠

	had a shorter period of low numbers over winter than the previous 3 years. Population monitoring (adult and pup counts) have occurred at the Victorian maternity sites over summer, with multiple visits to the Warrnambool maternity site during the breeding season. In December 2023, there was a mass mortality event with 780 dead pups found in the Warrnambool maternity site: the cause of death is unknown.	
Objective 2. Determine the main cause/s of the recent decline in numbers of Southern Bent-wing Bats, and identify causal factors to enable targeted, rapid management responses to be implemented.		
Action 2.1 Risk assessment to prioritise threats & actions. Develop implementation plan	The 2023 Annual Report serves as a mid-term review of the recovery plan and prioritisation of included actions. The Specific Needs Assessment resumed, with cost estimates being developed prior to finalisation.	
Action 2.2 Monitor health (including risk of WNS)	Zoos Victoria undertook pathology tests to investigate the cause of the pup mass mortality at the Warrnambool maternity site, but no clear cause of death was determined. An article to educate European cavers on the risk of introducing WNS to Australia was submitted for publication in an international caving association newsletter. European cavers were targeted, as there is lower awareness of WNS in Europe compared to North America, because WNS does not cause fatalities in Europe. Members of the Recovery Team presented on an Australian perspective on WNS prevention, preparedness and research at the annual North American virtual WNS meeting. WHA's WNS documents (advice for public, advice for veterinarians, biosecurity guidelines for cave research, and WNS fact sheet) were updated with input from subgroup members, following a revision of the US decontamination protocol. DEW have updated the draft Biosecurity procedure for Naracoorte Caves following further consultation, which will become a policy and procedure document in future. SA research permit conditions have also been updated to reflect the risk of introducing WNS. A PhD student at Western Sydney University co-supervised by Recovery Team members is studying SBWBs in SA as part of the White Nose Syndrome ARC Linkage grant project. They are investigating the frequency of arousal from torpor over winter, as well as the temperature and relative humidity inside and outside three non-maternity roosts in SA, to inform the risk of WNS for SBWB. Recovery Team members	

	are providing in-field support to this project. A PhD candidate at the University of Melbourne, supervised by Recovery Team members, has collected seasonal blood samples over 2024 and continues analysing blood cell counts, immune proteins and seasonal variation in immune potential of male and female bats. She also visited the Leibniz Institute for Zoo and Wildlife Research in Berlin, where she worked on European bat cell lines. This project is also part of the WNS ARC Linkage project aimed at informing the risk of WNS to SBWB.	
Action 2.3 Determine survival rates	A PhD candidate at Adelaide University is continuing to collect, collate and analyse PIT-tag data to form cohort-specific survival rates for Southern Bent-wing Bats in South Australia. Data collection will continue over the summer of 2024/25 due to the predicted dry conditions to investigate the impact of climatic variation on survival rates.	
Action 2.4 Assess breeding success	Progress is being made on the installation of the infrared cameras in the Warrnambool maternity site that will assist in assessing breeding success (DEECA). The mass mortality of pups at the Warrnambool maternity site is likely to have a significant impact on breeding success for the 2023/24 season. ARI gave a presentation on the pup mortality event at the Warrnambool maternity site (and mortalities of pups at the Victorian Eastern Bent-wing Bat maternity site) at the Australasian Bat Society conference in April 2024, to canvass thoughts from participants regarding the cause and asked if similar events had been observed for Eastern Bent-wing Bats in other states. N2 and PIT-tag data have been used to estimate the number of pups born in the 2023/24 breeding season at Naracoorte maternity cave.	
Action 2.5 Determine maternity cave microclimatic conditions & water use	An approach for using a modified trampoline and pond liner is being developed for use as a temporary water source. This will be placed near the Naracoorte maternity site and monitored with bat detectors, cameras and a PIT-tag reader to investigate whether SBWB use it for drinking. As part of this trial these techniques will also be used at local dams and the pools in Mosquito Creek. Low groundwater levels in southeast SA have prompted a review of the Lower Limestone Coast Water Allocation Plan. Low groundwater levels will likely reduce available water for SBWB and their prey species in the landscape.	
Action 2.6 Strategic survey of numbers, usage & seasonal patterns at non-breeding sites	As part of the monitoring of the maternity sites in Victoria, counts were undertaken on the same nights at the key associated non-breeding sites. Multiple Recovery Team members were involved in this ARI/DEECA led project. As part of the GPS tracking based out of Portland during this reporting period (see Action 2.8), many of the non-	

	breeding caves throughout SBWB's range were visited in an attempt to retrieve transmitters. Records were taken of the approximate number of bats using the sites during this work. Multiple Recovery Team members were involved in this ARI/DEECA project, funded by GHCMA. On a visit to an important South Australian non-maternity roost in August 2024, bats were seen roosting in a new location in the cave, closer to the entrance than seen before (Adelaide University). Planning has commenced for passive monitoring at up to 10 non-breeding sites using Audiomoths to determine presence and duration of occupancy as part of NHT project (LCLB).	
Action 2.7 Survey for additional unidentified roosts		🔴
Action 2.8 Determine foraging availability	Recovery Team members assisted ARI/DEECA to undertake extensive GPS tracking of SBWB in February/March 2024, fitting transmitters to bats caught near Portland and determining foraging locations and movement patterns, with many long distance movements recorded. This work was funded by the GHCMA and the Commonwealth government. The Recovery Team supported a grant application by 'The Friends of Bool and Hacks Lagoons' to monitor bat activity (including SBWBs) activity at Bool Lagoon. Monitoring bat activity at the revegetation works around the Warrnambool maternity site is continuing to assess changes in foraging behaviour.	🟠
Action 2.9 Investigate diet	NGT received funding through LCLB to run six 'Insect workshops' with the special inclusion of SBWB diet of moths at one event. GHCMA are encouraging members of public in the Glenelg-Hopkins CMA to photograph moths and upload images to iNaturalist for identification. This project and outreach aims to increase the current understanding of seasonal abundances of moths in the region, particularly SBWB prey species.	🟠
Action 2.10 Investigate impact of pesticides		🔴
Action 2.11 Investigate impact of wind farms	A joint ministerial statement was released by the Victorian Government outlining commitments to development of policy, guidance and research relating to managing bat and bird impacts at wind farms in Victoria. The statement can be found here: A better approach to managing biodiversity impacts of renewable energy projects	🟠

	Research commenced in January 2024 (ARI/DEECA) to investigate wind farm impacts and assess the effectiveness of potential mitigations. Projects relating to SBWBs include undertaking mortality estimates and investigating drivers of mortalities, investigating the flight height of SBWB from GPS tracking, investigating the potential effectiveness of a wide range of mitigations using an expert elicitation process, and developing the evidence base for improved guidelines. In addition, several ARC funding applications have been submitted to further investigate wind farm impacts (ARI, Adelaide University).	
Action 2.12 Determine suitable cave-gate design	A solid cave gate was modified at an Eastern Bent-wing Bat historical roosting cave in August 2023. The solid gate was installed in the 1920s to restrict access to the cave, stopping bat access. A hole of ~ 140mm x 400mm was cut in the gate and Eastern Bent-wing Bats have reoccupied the site. A similar design or gate of similar dimensions may suit SBWB (ASF).	🔴
Action 2.13 Feasibility of an artificial maternity cave		🔴
Objective 3. Protect the maternity sites and other key non-breeding sites.		🟠
Action 3.1 Active management to protect maternity sites	Security cameras were installed above the Warrnambool maternity cave to deter and monitor human visitation. The security camera within the mouth of the Warrnambool maternity cave has been monitored with photos of illegal trespassers captured.	🟠
Action 3.2 Management plans for key non-breeding sites	Management plans for three non-maternity roosts in SA have been developed following the South Australian cave audit. These three plans are the final components to the SA Cave Audit Grassroots Grant project which has been completed (NGT). NGT and LCLB Recovery Team members met with a representative at OnefortyOne to discuss management of SBWB caves within OneFortyOne managed plantations.	🟠
Action 3.3 Control introduced predators	Recent evidence of fox presence has been noted at non-maternity roosts in Vic and SA, and the Warrnambool maternity site. Rodent control continues at the Naracoorte Caves and has commenced at the Warrnambool maternity site.	🟠
Action 3.4 Erect/maintain signs to limit cave access	The signs in and above the Warrnambool maternity sites to discourage access have been maintained. Planning has commenced for sign updates/replacement at non-breeding caves in SA. Sensitive data nomination submitted to DEW from LCLB to obscure roost sites from public database.	🟠

	The Recovery Team acknowledges that this action should be broadened to encompass other actions to reduce disturbance at roost sites (e.g. fencing, surveillance and compliance).	
Action 3.5 Provide information & advice for council planning processes	DEECA/ARI have been working with the Warrnambool City Council on a planning permit to construct a shed to house the infrared camera monitoring equipment. In the process the importance of this site has been reinforced. LCLB have been liaising with Watte Range Council regarding management of a non-breeding cave on council managed land.	🟠
Action 3.6 Provide information to state agencies for fire planning processes	Non-breeding cave locations in SA have been added to DEW's natural values layer, to assist with protection during fire suppression operations. These locations are only available to DEW Natural Values team members.	🟠
Action 3.7 Develop & promote a code of conduct for cave visits	NGT's cave management plans, created through the South Australian cave audit project, include an appendix of best-practice guidelines for entry into these caves. DEW have reviewed and updated biosecurity regulations for researchers in bat caves or working with bats. These regulations focus on measures to prevent the introduction of WNS to Australian bats. DEW is currently in the process of reviewing and updating permit conditions for recreational cavers with scenarios based on no WNS present and also if an incursion of WNS had occurred	🟠
Objective 4. Protect and enhance foraging habitat around the maternity sites and key non-breeding sites.		🟠
Action 4.1 Protect key areas of foraging habitat		🔴
Action 4.2 Restore & enhance foraging habitat	Some of the direct seeding revegetation work at the Warrnambool maternity site, planted in 2022, has started growing. Revegetation sites have been identified for the NHT project in South Australia around Naracoorte Caves, Bool Lagoon and Mosquito Creek. Seedlings have been ordered for the first planting year (2025).	🟠
Objective 5. Clarify the taxonomic status, distribution and population structure of the Southern Bent-wing Bat.		🟠
Action 5.1 Clarify taxonomy	The Recovery Team are encouraging the researchers who previously studied SBWB taxonomy to publish their findings, reaffirming its importance .	🟠
Action 5.2 Clarify extent of	A PhD candidate at the University of Melbourne, supervised by a Recovery Team member, is preparing for publication	🟠

geographic range based on genetics	her data clarifying the geographic range of SBWB and EBWBs.	
Action 5.3 Develop field-ID tool to distinguish between Southern Bent-wing Bats & Eastern Bent-wing Bats		🔴
Action 5.4 Improve understanding of population structure for informing recovery	A PhD candidate at the University of Melbourne, supervised by a Recovery Team member continues to analyse her data on genetic population structure. A PhD candidate at Adelaide University, supervised by Recovery Team members, is planning an additional study exploring movements between roosts which will improve understanding of population structure, as part of her PhD. During this reporting period, ad hoc sampling has detected at least 25 PIT-tagged SBWBs in Victoria, that were tagged at the maternity roost for the Naracoorte/SA subpopulation. The majority of these bats have been detected multiple times at caves near Portland, and then subsequently detected in South Australian caves. Two of these bats, originally tagged at Naracoorte, have also been detected at the Warrnambool maternity roost, and returned to Naracoorte shortly after detection in Warrnambool. Bats have been detected with manual scanning during non-related fieldwork and temporary installation of PIT-tag readers for short periods, in multiple seasons. This suggests there may be more regular interchange between the subpopulations than previously thought, although the full extent of this is yet to be determined (Adelaide University).	🟠
Objective 6. Compile and maintain databases to aid in the management of the subspecies.		🟠
Action 6.1 Compile, maintain & assess information on roost sites	CEGSA members recently visited a cave with a history of bat use in SA and encountered no evidence of recent bat usage, and let the Recovery Team know. LCLB are compiling a secure spatial database on non-breeding caves and numbers in South Australia as part of the NHT project.	🟠
Action 6.2 Develop a project register	The research subgroup has proactively been working to establish a number of studies deemed high priority at the November 2023 workshop, generally focused on SBWB diet. Multiple project plans are in draft.	🟠
Objective 7. Establish a long-term monitoring program for the Southern Bent-wing Bat.		🟠
Action 7.1 Design & implement	Long-term monitoring is continuing at all three maternity sites and their associated non-breeding sites, with the	🟠

monitoring program with an adaptive management framework	findings fed back into the management of these sites using an adaptive management approach.	
Objective 8. Facilitate and promote community interest, understanding and participation.		
Action 8.1 Develop & implement communication plan	The communications plan continues to be used to guide media and communications on the SBWB by the RT. A communications plan and engagement page has been developed for the NHT project and there will be regular media and social media posts to increase community awareness and engagement with the project.	
Action 8.2 Change perceptions of landholders about pesticide use	A recent publication and media release related to increased pesticide use in the US (resulting from WNS driven bat declines) has concluded this increase in pesticide use is increasing infant mortality rates in humans. Though this does not relate to SBWB specifically, this article and media release presents a good case study for communications, and has been mentioned in multiple presentations and community events hosting SBWB Recovery Team members. A communications plan is being developed for the 'Bat Friendly Farms' component of the NHT project. This will include messaging around pesticide use and impacts on bats, as well as the pest control benefits that bats provide.	
Action 8.3 Maintain & strengthen relationships with community organisations	An article on SBWBs was included in the Trust For Nature Bulletin magazine (input from Recovery Team members at ARI). Multiple Recovery Team members presented at the 2024 Australasian Bat Society Conference in Adelaide. Presentations from Recovery Team members summarised key updates in international research on WNS (WHA), and emphasised the risk that the introduction of the fungus causing WNS would pose to SBWB and Australian bats. Other Recovery Team members presented research on SBWB's seasonal partitioning of emergence and return times between cohorts (Adelaide University), and the recent mass mortality of pups at the Warrnambool maternity site (ARI, Zoos Victoria) (see 2.4). A free presentation, 'Learn about the Southern Bent-wing Bat' was live-streamed from the Naracoorte Caves World Heritage area, organised by DEW with a Recovery Team member from Adelaide University presenting. The event was well attended by the general public and numerous bat carers. Southern Bent-wing Bats were discussed in detail, with recent research, Recovery Team efforts to conserve the species, and the major threats SBWB are facing. A recording will become available.	

	A Recovery Team member spoke about SBWB at a 'Night of Science' and the Naracoorte MegaFest in early November 2024, events which celebrate the Naracoorte Caves (DEW, Adelaide University). LCLB funded and organised a bat night at the Naracoorte Caves in November 2024, where the local community and community groups learnt about SBWB and the ongoing work to conserve them. Recovery Team members from Adelaide University, DEW and LCLB at this event, which was well attended. LCLB delivered presentations to Landscape Board Members and South East Water Conservation and Drainage Board members in August and to Landscape Board staff in November, increasing awareness about SBWB ecology and threats and how the NHT project is addressing these threats and encouraging broader staff involvement in the project.	
Action 8.4 Increase community participation in revegetation of foraging habitat & cave protection & restoration	A new, more weatherproof solution to the fence padding around the Naracoorte maternity caveis being designed, in conjunction with the Friends of Naracoorte Caves (LCLB, DEW, Recovery Team and network members). LCLB met with A/president Bool and Hacks Lagoon regarding revegetation at Bool Lagoon and Naracoorte Caves.	🟠
Action 8.5 Develop closer links with Indigenous groups	ARI are working closely with Eastern Maar (Traditional Owners of the Warrnambool area) both on protecting, monitoring and improving the Warrnambool maternity site, and investigating if SBWBs may be using other culturally important sites. LCLB have been working closely with Burrandies Aboriginal Corporation to improve habitat quality and access to roosts (for SBWB) at multiple roosts within south-east South Australia, and is liaising with the South East Aboriginal Focus Group to plan management of a roosting site with culturally significance. Burrandies have been contracted to undertake weed control and sign installation at key sites.	🟠
Objective 9. Provide direction and guidance to the recovery of the Southern Bent-wing Bat and review the success of the Recovery Plan.		🟠
Action 9.1 Establish a Southern Bent-wing Bat Recovery Team		🟢
Action 9.2 Conduct a mid-term review of the Recovery Plan	Undertaken in conjunction with the 2023 Annual Report.	🟢

Action 9.3 Review implementation of the Recovery Plan & re-assess status of subspecies after five years	Not due for another year.	
Management practices (status not listed as these practices are ongoing)		
Parks & reserves with roosting caves: Closer monitoring of population numbers. Monitoring & reducing impacts from human disturbance, predation by introduced predators & encroachment by weeds	Regular servicing of in-cave IR cameras was successfully completed at Naracoorte maternity cave (involving DEW, LCLB and other Recovery Team and network members). A camera in the 'drinking straws' chamber has been turned on after being off for a year and is providing a detailed view of roosting bats, and water availability on stalactites which bats drink from. Continued the reduction of visitation to Blanche Cave (near Naracoorte maternity cave) between May-September. Large numbers of torpid bats were reported in the cave by visiting researchers (West Sydney University, assisted by Recovery Team members), suggesting the cessation of tours is benefiting bats using this site. Discussions have begun regarding updating the fence padding surrounding Naracoorte maternity caveto a more durable material that serves the same purpose as the temporary solution (reducing collision risk for juvenile bats). New padding is expected to be erected before June 2025 (DEW, LCLB and other Recovery Team and network members).	
Aim to prevent any further native vegetation removal in terrestrial or wetland environments throughout the SBWB range. Develop decision-making tools (e.g. overlays) to help government & land managers to identify important areas		
Planned burning should be undertaken in such a way as to		

minimise impact on foraging habitat		
Aim to increase the amount of foraging habitat in the vicinity of key roost sites	LCLB are planning revegetation to increase moth activity and availability near the Naracoorte maternity roost. Revegetation growth around the Warrnambool maternity cave is progressing. Monitoring bat activity at sites in and nearby the revegetation works in continuing (ARI).	
Strictly enforce restrictions on items capable of carrying the fungus that causes WNS	The decontamination protocol for *Pd* in North America has been updated, prompting WHA to update the Australian WNS decontamination protocol in various publicly available documents. DEW have worked with the Recovery Team to create a paragraph about WNS and enforce conditions on research permits with SBWB or in caves in the region.	
Liaison with Indigenous groups over the management of caves with cultural heritage values	LCLB requested a discussion on the management of a roost cave with cultural heritage value at a meeting of the South East Aboriginal Focus Group. SEAFG support proposed weed removal works and maintaining current entrance access and security at a non-breeding cave which is also a cultural site.	
Avoid & minimise the impact of wind farms on any key areas used by the SBWB (defined using a risk-based approach). Mitigation actions, rigorous pre- & post- construction monitoring, sharing of mortality data required for any wind farms built in key areas or migration routes	Post-construction mortality monitoring continues at some operating wind farms within the range of SBWB in Victoria, and mortalities are reported to DEECA. Annual mortality rates are being estimated. New policy statements are being developed in Victoria with the aim of reducing the impact of wind farms on bats and birds, with the SBWB a key species of focus. Guidelines have been drafted to improve the quality of pre- and post-construction assessments and monitoring.	

3. TRACKING CHANGES IN THE state/ condition and CONSERVATION TRAJECTORY

Summary state in 2021	
Abundance	In the 2020/21 breeding season, there were between 28,800 and 35,200 individuals estimated to be roosting at Naracoorte maternity cave (December 2020). This estimate included first-year individuals not yet reproductively mature, but not new-born pups. In 2020/21 the Warrnambool population (based on the Warrnambool maternity site and surrounding non-breeding sites), ranged between 17,233 and 18,299 adults early in the breeding season. Once the young had started flying, the total adult and young of the year counts ranged from 22,391 to 23,545, with the difference between the early and late periods representing the number of young that reached independence. These figures are based on a 95% confidence interval from the automated counting process. Counts of the Portland population (the Portland maternity site and nearby non-breeding sites) were not available for 2021. However, in 2020, there were estimated to be 1000-1500 individuals, including non-reproducing individuals. It should be noted that the automated counting programs used to estimate population size, batTracker (Victoria) and N2 (South Australia), are continuing to be refined. Victorian population estimates are currently being re-evaluated and may be amended in coming years. Increasing knowledge of these animals and populations is informing refinements to batTracker and N2. Old counts will be re-processed to ensure consistent methodology and the highest possible accuracy in population estimates.
Distribution	The Southern Bent-wing Bat has a restricted distributed (19,452 km^2) from south-eastern South Australia (around Robe, Naracoorte and Port MacDonnell) to south-western Victoria (east to Lorne and Pomborneit). There are two major maternity sites with long histories of occupation: Naracoorte maternity cave, which lies within the Naracoorte Caves National Park in South Australia and a cave near Warrnambool in Victoria. A third, smaller

	maternity site near Portland, Victoria was discovered in 2015 and accounted for about 3% of the entire breeding population in 2020.
Threats	A range of threats have been identified as potentially impacting on the Southern Bent-wing Bat; however, the main cause(s) of the severe decline in numbers and the mechanisms of that decline are unclear. Identified known and/or potential threats include damage or destruction of roost sites, clearing and modification of foraging habitat, disease (including the risk of WNS), climate change (including increased impact of drought), human visitation/disturbance at caves, introduced predators, inappropriate fencing, collisions with turbines at wind farms, fire, and accumulation of pesticides or other toxins.
Current known state in 2024	
Abundance	<u>Naracoorte maternity cave</u> In December 2023, the adult (and subadult) population at Naracoorte maternity cave reached a maximum of approximately 27,514 individuals based on the N2 counts. Pups were born in the maternity chamber from November 17, with the majority weaned by late January. In late January, the total population (adults + subadults + pups) peaked at approximately 34,928 individuals. The difference between the peak total population count after weaning, and the peak adult population estimate in December 2023 indicates at least 7,414 young weaned at Naracoorte maternity cave during the 2023/24 breeding season. Despite the apparently high reproductive success in the 2023/24 season, the peak adult/subadult population estimate as of November 2024 has not increased, with an estimated 26,482 bats present at the cave (adults and subadults). <u>Victorian Populations</u> Population counts at the maternity and nearby non-breeding caves occurred in December 2023 (adults) and January 2024 (adults), and March 2024 adults and newly volant young. Recording of thermal infrared footage of bats leaving the cave at sunset is currently recorded in person limiting the number of counts done for each period. Two counts were run though the automated counting system batTracker for each time period yielding highly variable

	results. The numbers at the nearby non-breeding roosts (within 30 kms) were also factored into the results in case large number of bats were roosting at these locations on the days of the population counts. The difference between the estimates for each of the two nights was approximately 800 in December/ January and approximately 3,000 in March. In December/ January the count ranged from 18,021 to 19,170 (lowest and highest 95% CI for the 2 nights). In March they ranged from 19,152 to 23,786 (lowest and highest 95% CI for the 2 nights). The disparity between counts in each of the time periods may have been due to several factors including (a) bats were roosting at unsurveyed non-breeding roosts farther afield on the nights with low counts or (b) video recording images were more noisy than usual, resulting in the automated system either under or overestimating numbers. Both of these factors are possible, with no counts at the Camperdown roost occurring on the same nights as counts at the Warrnambool maternity roost and nearby non-breeding roosts, with the numbers inferred from the counts undertaken either side of the counts at the maternity site. This roost is well within the nightly flight range of bats from the Warrnambool maternity site and bats with GPS tags have been tracked moving regularly between them. The variation in numbers at this roost is largely unknown but it can be highly variable at the roosts closer to the maternity roost, and so is likely variable at this site as well. Most of the thermal video recordings were quite noisy this season, however some manual counting was undertaken for each night to calibrate the automated counting system and standard errors were low (all less than 500, with three of the four being less than 120). Due to the high variability between the counts in the same time periods and the fact that the highest 95 % CI for December/January was similar to the lowest for March, it is difficult to confidently estimate the population numbers and population recruitment for this breeding season from flyout recordings. Ideally more counts would have occurred to provide more confidence in the results. This will hopefully occur in future with the installation of a more permanent camera at the entrance to the maternity cave to regularly record flyouts.

	In December/January many of the pups were roosting in an area of the maternity cave that was partially obscured from view so surviving pup numbers (i.e. those that did not die during the pup mortality event) and resulting recruitment into the population could not be estimated from photos for this breeding season.
Distribution	It is probable that there has been no actual change in the distribution since the previous reporting period. However, our understanding of the distribution has changed through GPS tracking which has indicated that areas in far western Victoria between Portland, Lower Glenelg National Park, Mount Gambier and Naracoorte, and to the northeast and southeast of Naracoorte within Victoria are used for foraging more than previously recognised, largely by individuals from the Naracoorte and Portland populations. This change has now been reflected on various distribution maps, such as the Australasian Bat Society BatMap. The distributions of subpopulations appear to be less isolated than previously thought, with individuals apparently moving between subpopulations in Spring and Summer. Additional sampling in Winter and Autumn is ongoing to determine the frequency and seasonality of these movements.
Threats	Threats remain the same as in the previous reporting period.

What is the current state/condition and conservation trajectory?

Population Estimates at Maternity Sites

Naracoorte maternity cave

The number of individuals recorded at Naracoorte maternity cave in the 2023/24 breeding season (27,514 adults and subadults, 34,928 adults, subadults and pups) is broadly similar to the number of individuals recorded in previous reporting periods at Naracoorte maternity cave. Late January 2024 population estimates suggest the 2023/24 season was one of high reproductive success for the Naracoorte maternity cave population. This is despite the adult/subadult population estimate from December 2023 being lower than all previous reporting periods, including the summary state of 2021. In the 2021/22 breeding season, 27,900 adults/subadults were estimated during December, which is largely similar to this season's estimates.

Table 1. Population estimates from 2021-present at the Naracoorte Maternity Cave, before juveniles become volant (Nov/Dec) and after (Jan/Feb).

Breeding season	Peak adult & subadult numbers (Nov/Dec)	Peak adult, subadult & pup numbers (Jan/Feb)
2020/21	28,800	35,200

2021/22	27,900	34,100
2022/23	30,625	34,403
2023/24	27,514	34,928

As of November 2024, 26,482 adults/subadults have returned to Naracoorte maternity cave. This is not the final estimate of adult/subadult population size for the 2024/25 breeding season as more individuals may return during the November/December period.

As a result of the fluctuations in peak numbers between years, it is not possible to make inferences about the current population trend, and more years of data, including during periods of climatic variability are needed.

In addition, population estimates at Naracoorte maternity cavevary throughout the year, and between seasons, but this is not to be interpreted as a change in population trajectory as individuals are likely to be spread across a range of roost sites.

Warrnambool

A mass mortality event at the Warrnambool maternity roost, resulting in the death of at least 780 newborn pups will have reduced the population's reproductive output this season.

The population numbers appear to have remained broadly similar in recent years since a relatively consistent counting method was introduced in 2018/19 (Figure 1), especially the combined adult, subadult and young of the year numbers in the February/March period. However, as there are only a few counts each year, and these have variable levels of error, it may be difficult to detect subtle changes in numbers. For the counts in 2018/19 to 2020/21, only the maternity site and the two nearby non-breeding roosts (within 20 km) were monitored. In subsequent years an additional non-breeding roost near Camperdown (> 60 km away), was included after it was identified from GPS tracking that bats were regularly flying to this roost from the maternity and nearby non-breeding roosts, which will have contributed to the overall numbers in the latter years. The ongoing improvement in processing, calibrating and analysis of video footage with the automated counting program has resulted in a reduction in counting error (i.e. narrower 95% confidence bounds in counts). The earlier counts will be revised using an identical method to the later counts to make them more comparable.

Although fluctuating to some extent, over the last six years the peak numbers (i.e. adults, subadults and young of the year) were in the vicinity of a mean of 24,000 individuals (Figure 1). This total figure was lower in 2023/24 summer compared to previous years, with both of the counts in March lower. These two counts differed by approximately 3000 individuals (i.e. approximately 20,000 and 23,000 mean number of individuals). The cause of the difference between these two counts is not clear, however with both counts lower than previous years this difference is likely attributed to the pup mass mortality event resulting in fewer pups than usual being recruited into the population.

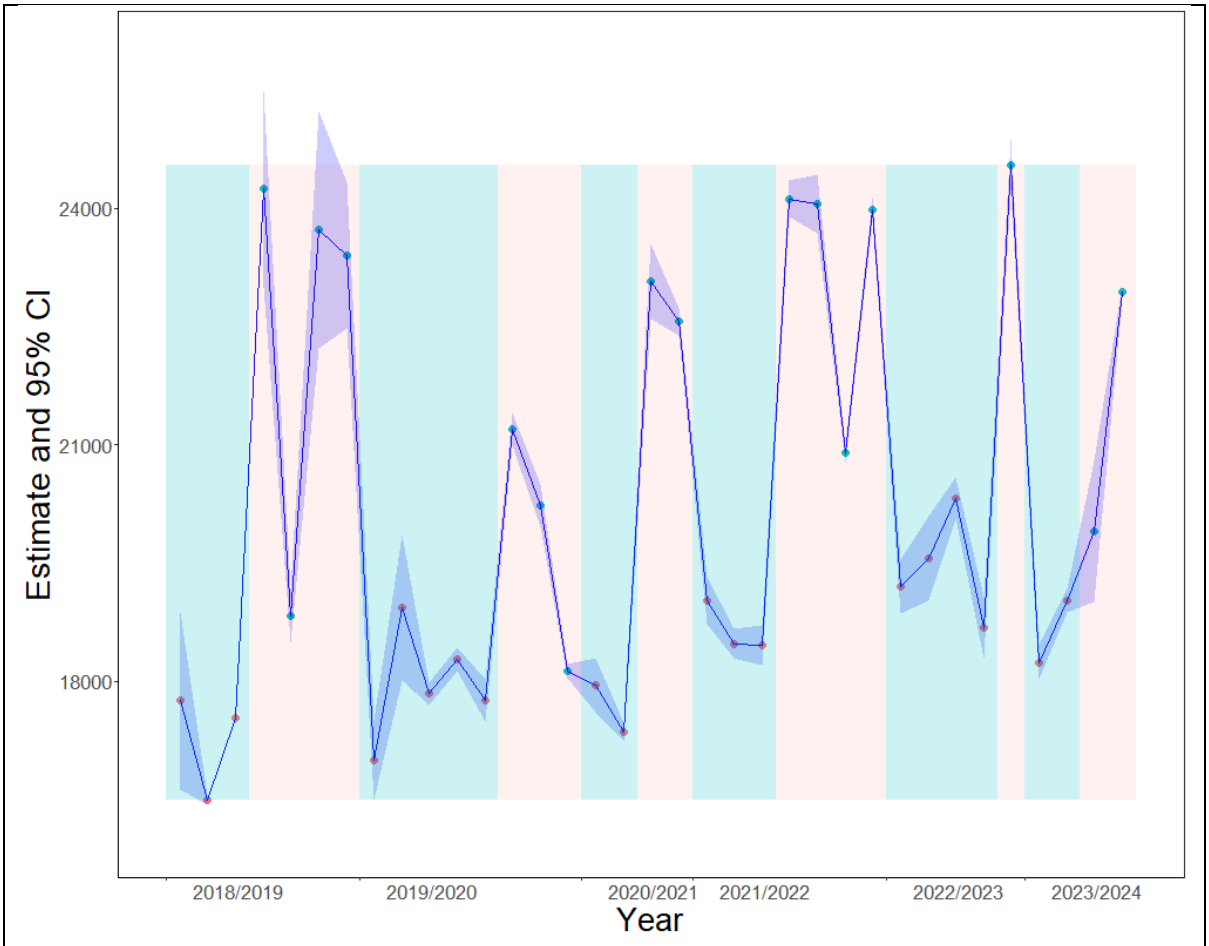


Figure 1. Counts of the Warrnambool SBWB subpopulation over six summers at the maternity and non-breeding roosts including 95% confidence intervals. Counts occurred in two time periods, in December/January when only adults and subadults were flying (blue background and pink points) and February/March when adults, subadults and young of the year were flying (pink background and blue points). The two nearby non-breeding roosts have been monitored on the same night as the maternity roost since 2018/19, with a third being included in since 2020/21. The peak numbers in the February/March period have remained relatively consistent over this period, although these were lower in 2023/24.

Portland

Due to the difficulty in accessing the Portland maternity site, it has not been possible to obtain counts of the number of adults and pups each breeding season. Therefore there is currently insufficient data to assess current population numbers and trends for this subpopulation, however, the population size is considerably smaller than for the other two subpopuations.

4. SUPPORTING INFORMATION

Recovery Team Report
In the past 12 months, the Southern Bent-wing Bat National Recovery Team has had four on-line meetings to discuss progress and issues relating to the recovery of the Southern Bent-wing Bat. Funding of the coordinator position has been extended by Zoos Victoria, allowing for the position to continue. Several subgroups of the Recovery Team are continuing to actively work on specific tasks, guided by the Recovery Plan, and identified by the Recovery Team. Several subgroups met multiple times in the past 12 months. The Biosecurity and Surveillance Subgroup has met multiple times, updated membership, investigated potential projects and successfully updated and/or formulated multiple documents from the RT, WHA and DEW. Changes in the approved WNS decontamination protocol in North America prompted updating of multiple published documents. The Recovery Team greatly appreciate the leadership taken by this subgroup and for their continued motivation and efforts in the past year. The Research Subgroup has met multiple times this year, creating project plans and discussing research priorities. These potential research projects aim to fill knowledge gaps in the current understanding of SBWB in order to better conserve the subspecies. Some planned projects aim to increase the understanding of the diet of the SBWB. The Cave Audit Subgroup met and communicated outside meetings to assist NGT in the development of management plans for non-maternity roosts. LCLB have joined the subgroup and is developing management plans and actions for other non-maternity roosts in the region as part of the NHT project. The Wind Farm Subgroup has met during the reporting period to discuss both state governments approaches to risk assessments, impacts and mitigation at wind farms. The Recovery Team and the Wind Farm subgroup have also discussed how best to update publicly available documents (such as the SBWB Conservation Advice) to reflect the current understanding of SBWB ecology and movements, as well as effectiveness of mitigations (especially curtailment) for reducing mortalities.

Future course of action
The National Recovery Team recommends ongoing implementation of the National Recovery Plan and current management plans for key sites. The Recovery Team should continue meeting regularly to address Recovery Plan actions, as well as actions arising from meetings. In 2025, the Recovery Team plan to meet in person for a workshop and discuss the full-term review of the National Recovery Plan for SBWB. The Recovery Team supports implementation of low windspeed curtailment at wind farms in the SBWB range to reduce mortalities from turbine collisions, as also recommended in the SBWB Action Statement under the Victorian FFG Act (DEECA 2023). Completion of the installation of the in-cave cameras at the Warrnambool maternity roost will provide valuable information. These cameras will allow for more frequent monitoring of population size of adults and pups , as well as behavioural observations. Continuation of the nightly N2 observations at Naracoorte maternity cave will provide invaluable data on short and longer term fluctuations in numbers at this maternity site. Rainfall and groundwater levels across the subspecies range have been notably lower in this reporting period than in previous years. Considering previously recorded declines in survival during drought, the Recovery Team are monitoring drinking water availability in South Australia and planning to trial artificial water sources that may be used by bats in the summer of 2024/25. The Recovery Team encourages further research into SBWB ecology and foraging habits in order to guide revegetation and recovery efforts. There has been continued discussion during Recovery Team and subgroup meetings regarding the need for assessments of prey availability, especially moths, within the SBWB range. Movements between subpopulations by SBWB warrant further investigation including the frequency, seasonality and variation between cohorts. The long distance movements recorded recently have implications for the availability of foraging resources, and the risk of collisions with wind turbines across the range of the SBWB. More information is required on seasonal abundance and diversity of moths in southwest Victoria and southeast SA to inform revegetation programs to enable planting species that would host prey species for SBWB throughout the year. The Recovery Team will continue to explore projects and build networks with entomologists and ecologists that could increase knowledge on SBWB prey species requirements, in order to increase resource availability. The Recovery Team supports NGT and GHCMA's efforts to engage the local community in insect identification and monitoring. Any further efforts by community groups or research institutions to systematically survey for moths within the SBWB range are strongly encouraged by the Recovery Team. Researchers or managers working with SBWB or entering their roost caves should be on the lookout for signs of *Pd* and WNS in case the pathogen is inadvertently introduced to Australia. In-situ, targeted surveillance for *Pd* at SBWB roost caves is encouraged if possible. There is a plan to update the WNS response guidelines, given the changes to the decontamination protocol in 2019. The findings of the ARC Linkage grant, including Anna Langguth and Tomas Villada-Cadavid's PhD projects, are likely to inform how WNS may impact SBWB, and these findings and implications will be incorporated into the national WNS response guidelines when available. Communications increasing awareness of SBWB and the threats the species is facing should continue, with an emphasis on discouraging disturbance at SBWB roosts.

Communications to Australian and international caving communities regarding WNS and the risk it poses to Australian bats should continue.

The Recovery Team will continue to work with the LCLB as they deliver their NHT SBWB project, to provide advice and receive updates. The Recovery Team support the activities planned for this project and appreciate the value LCLB are placing on their input and involvement in delivering this project.

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Appendix 1: Conservation assessment criteria

State/condition and prospects for long term survival in the wild

How do you rate the state/condition of the species or ecological community and its prospects for long term survival of the in the wild, based on current information? If there are limited data available, it may be appropriate to make a qualitative assessment based on expert assessment.

State/condition grades		Criteria
	Very good	The species appears to have **very good** prospects for long term survival in the wild, based on an evaluation of the parameters outlined in section 4, such as abundance, distribution, habitat condition or the impact of threats.
	Good	The species appears to have **good** prospects for long term survival in the wild, based on an evaluation of the parameters outlined in section 4, such as abundance, distribution, habitat condition or the impact of threats.
	Poor	The species appears to have **poor** prospects for long term survival in the wild, based on an evaluation of the parameters outlined in section 4, such as abundance, distribution, habitat condition or the impact of threats.
	Very poor	The species appears to have **very poor** prospects for long term survival in the wild, based on an evaluation of the parameters outlined in section 4, such as abundance, distribution, habitat condition or the impact of threats.

Conservation trajectory

What is the conservation trajectory of the species or ecological community in terms of whether it is improving, deteriorating, or stable? If possible refer to the 'national listing criteria for species and ecological communities' and make a determination of the conservation trajectory using at least one criteria.

Recent trend	Criteria **(for example)**
Improving	Increase in population numbers or the geographic distribution of the species or ecological community
Deteriorating	Decrease in population numbers or the geographic distribution of the species or ecological community.
Stable	Population numbers or the geographic distribution of the species or ecological community are stable.
Unclear	There is insufficient information to make an estimate of the conservation trajectory of the species or ecological community.

Level of confidence

What is your level of confidence in these estimates based on the available evidence and the consensus of experts?

○ Evidence and consensus too low to make an assessment ◒ Limited evidence or limited consensus ● Adequate high-quality evidence and high consensus