Southern Bent-wing Bat
National Recovery Team
Annual Progress Report 2021

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

November 2021

Acknowledgements

The format of this progress report has been adapted from the *Recovery team annual progress report (draft)*, Commonwealth of Australia 2017. Cover image credit: Lindy Lumsden.

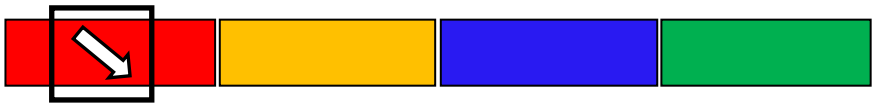
List of abbreviations

ARI	Arthur Rylah Institute for Environmental Research, DELWP
DELWP	Department of Environment, Land, Water and Planning, Victoria
DEW	Department of Environment and Water, South Australia
EPBC Act	Commonwealth Environment Protection and Biodiversity Act 1999
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
WNS	White-nose Syndrome

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@delwp.vic.gov.au
Date of report	November 2021

State/condition and conservation trajectory



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

Confidence Adequate high-quality evidence and high level of consensus

Key highlights

- The National Recovery Plan for the Southern Bent-wing Bat was adopted by the federal Minister for the Environment in November 2020, formalising the plan being implemented by the Recovery Team.
- The Southern Bent-wing Bat's threatened status was reassessed and retained at Critically Endangered under the EPBC Act. The updated Conservation Advice came into effect in June 2021 and contains the latest knowledge about the SBWB's ecology, population trends and threats, as provided by the Recovery Team.
- An intensive investigation phase has been underway over the last six years to inform species recovery, and much has been learnt over this time, however, there remain some key knowledge gaps and further research projects have commenced to address these unknowns.
- Significant progress has been made to assess risk of White-nose Syndrome (a fungal disease resulting in the death of millions of bats in North America) to the SBWB (and other bats in Australia) and to prepare response strategies. These steps will be strengthened by recently-commenced targeted research.
- All three maternity caves are now considered adequately protected, with active management in place at the two major maternity sites.
- Regular monitoring has continued at the two Victorian maternity sites and key non-breeding sites, and the development of a new monitoring program in 2021, using infra-red technology and specifically-developed software, will greatly enhance the regular, remote monitoring of population numbers at the Naracoorte maternity cave.
- The Recovery Team has commenced a Specific Needs assessment with DELWP to assess the most effective and feasible recovery actions to ensure conservation of the SBWB across its range over the next 50 years.
- Recovery efforts need to move from a largely investigation phase to now also include an increased focus on adaptive recovery, implementing management actions outlined in the Recovery Plan. Halting current decline of the SBWB, and successful recovery of the species, will require substantial funding to support recovery actions.
- Ongoing implementation of the National Recovery Plan is needed to meet the long-

term objective of ensuring that the Southern Bent-wing Bat can survive, flourish and retain its potential for evolutionary development in the wild.

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 October 2020 has been summarised, however, a brief outline of previous work has also been included where required to provide context for the progress that has been made to-date for each recovery action. 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.		🟠
<u>Action 1.1</u> Develop techniques to estimate population numbers, survival rates & breeding success	Various techniques have been developed for accurately estimating population size and trends. <u>Prior to October 2020</u> Development and refinement of the use of thermal imagery and an automated counting application batTracker for estimating fly-out numbers (Hield et al. 2019, Lumsden et al. 2020), infrared photography for counting numbers of pups (Lumsden et al. 2018), and counts of relative numbers of bats from infrared time lapse images. (This work is led by Amanda Bush and Lindy Lumsden at ARI). Development and optimisation of antenna systems for monitoring PIT-tagged bats at cave roosts, and confirmed minimal impacts of this marking technique for Southern Bent-wing Bats (van Harten et al. 2019, 2020) <u>This report</u> There has been significant progress towards the development and implementation of a new bat population monitoring program to conduct regular flyout counts at Bat Cave. The aim is that the counts could then be conducted by local staff or volunteers (e.g. Friends of Naracoorte Caves). New hardware has been tested over the last year.	🟠

	This includes cameras, lighting, computers and video storage). A new, user-friendly counting program, N2, has been developed and is working very well. Part of the funding for the program has been used to transfer the application out of the development software and into a stand-alone format that should enable it to be used by anyone, without cost. The project is currently on track for final testing to be completed this summer (2021/2022), with permanent installation maybe completed by the end of 2021 or the first quarter of 2022. The program has been funded by Zoos Victoria and supported by Naracoorte Caves NP. The project team includes Terry Reardon, Paul Clissold, Dennis Matthews, Tom Shortt and the Friends of Naracoorte Caves. The Recovery Team would like to acknowledge that Paul Clissold has put significant effort and time (working in a volunteer capacity) into the design of the project, developing the N2 program and the user-friendly application. As reported previously, methods for passively monitoring PIT-tagged bats at roosting sites have also been developed (van Harten 2020). At Bat Cave, the current PIT-monitoring system had to be installed within the cave due to the large dimensions of the cave entrance and limitations of the available technology. Terry Reardon and Dennis Matthews have spent a lot of time attempting to use a longer antenna to successfully detect tagged bats at the entrance to Bat Cave. This would have minimised the need for entry into the maternity cave to retrieve data. Unfortunately, despite much trouble-shooting and 'noise' reduction efforts, the system was unable to detect bats as effectively as the current system – even when a read-range of >1 m was achieved. A contributing factor is thought to be the fast speeds at which the bats exit the cave compared to when flying within the cave. To improve the ability to monitor when there may be problems with the existing system, a new modem system has recently been purchased and installed to enable monitoring of the system on a daily basis without needing to enter the cave (Terry Reardon and Lindy Lumsden). Significant progress has been made on developing new approaches for assessing pregnancy rates and breeding success. Nicola Bail (Masters student at Adelaide Uni supervised by Thomas Prowse and Lindy Lumsden) is working with specialist veterinarians to trial the use of ultrasound equipment to determine the pregnancy status of females, which is working very effectively.	
<u>Action 1.2</u> Assess population numbers & trends	In 2020, the Recovery Team prepared a substantial submission to the Threatened Species Scientific Committee, which formed the basis of the Southern Bent-wing Bat's reassessment under the EPBC Act, and updated Conservation Advice. The advice included population modelling which predicted deeply-concerning declining population trends over the next 36 years. More information	

	about this analysis is summarised in section 4 of this report (4. Tracking changes in the state/condition and conservation trajectory). Regular monitoring of population numbers continues to be undertaken at the Warrnambool maternity cave and nearby non-breeding caves from thermal fly-out imagery with multiple counts over four months during the summer period (Amanda Bush and Lindy Lumsden, ARI; Lumsden et al. 2019). As in 2020, in January 2021, a single count was undertaken at the Portland maternity cave, with concurrent fly-outs undertaken at nearby non-breeding caves to estimate population numbers in the Portland region. Inclement weather conditions prevented access when pups could easily be distinguished from adults. Only an overall population count will be available for the Portland population in 2021 with no estimates of pup numbers and breeding success possible. Population models were developed from PIT-tag data to model the population in South Australia (by age and sex classes) to reveal seasonal trends, activity patterns and movement in the population (Emmi van Harten, La Trobe Uni and supervisors Thomas Prowse, Terry Reardon and Lindy Lumsden). This work has now been completed and is available in Emmi's PhD thesis (van Harten 2020), with further papers expected to be published within the next 12 months. Key results show that bats congregate at the Bat Cave maternity site for most of the year (except for approx. one month in winter), although there are different seasonal movement and migration patterns among the sex and age classes, including a previously undescribed movement event by newly-independent juveniles and adult females over March each year. Overall, the population was more mobile than expected, with bats flying the 72 km between the two monitored roosting caves in just a few hours. Extended congregation of bats at Bat Cave highlights resource limitation in the surrounding area as a potential threat to this population. Ongoing monitoring of the PIT-tagged population is being undertaken by Terry Reardon, Dennis Matthews and others. Tom Shortt (Naracoorte Caves, DEW) and Rose Thompson (NGT) have also been assisting with collecting data and/or keeping the system going. A new cohort of bats are expected to be PIT-tagged as part of a Masters project by Nicola Bail in 2022.	
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.		
<u>Action 2.1</u> Risk assessment to prioritise threats & actions. Develop	A formal risk assessment and implementation plan has not been undertaken, however the Recovery Team has commenced a Specific Needs assessment through DELWP over the last 12 months. This is an expert elicitation process to identify the most effective species recovery actions and	

implementation plan	priorities with the resources available. The process is inclusive and allows for all experts and stakeholders to make contributions to the process. Varying experience and knowledge are taken into account in the analysis by individuals providing confidence intervals for each response. An online workshop was held with the Recovery Team in February 2021 to prioritise threats and select a set of potential actions that will be assessed in the elicitation phase. Several Team members have been assisting with drafting background information and clear, specific-specific framing of the actions that were selected during the workshop, to enable the next step in the process to begin. This assessment will be a priority for 2022. See Action 6.2 for progress prioritising research actions.	
Action 2.2 Monitor health (including risk of WNS)	Prior to October 2020 A comprehensive baseline health assessment was undertaken for the Southern Bent-wing Bat and Eastern Bent-wing Bat by Peter Holz (University of Melbourne, supervised by Jasmin Hufschmid and Lindy Lumsden) (Holz 2018). This involved studies on viruses (Holz et al. 2018a), fungi (Holz et al. 2018b), ectoparasites (Holz et al. 2018c), blood parasites (Holz et al. 2019a), pathology (Holz et al. 2019b), haematology (Holz et al. 2020a), and morphology (Holz et al. 2020b). No association was found between any of the infectious and parasitic agents surveyed and measures of the health of the individuals. However, Victorian Southern Bent-wing Bats had more herpesviruses, ectoparasites and parasitic blood infections, which was suggested to be indicative of some type of chronic stress impacting the immune system of this population (Holz 2018). An Australian risk assessment found that the fungus causing White-nose Syndrome (WNS) – which has resulted in millions of deaths of cave-roosting bats in North America – concluded that the introduction of WNS into Australia was ‘highly likely/almost certain’ over the next 10 years, and that it was ‘likely’ that Australian bats will be exposed to it (Holz et al. 2016, 2019c). All of the distribution of the Southern Bent-wing Bat is within the optimal temperature range for growth of the fungus causing WNS (Turbill and Welbergen 2020). Holz et al. (2018b) tested 325 Southern Bent-wing Bats and Eastern Bent-wing Bats for the fungus causing WNS. All samples were negative, which along with ongoing passive surveillance, supports the assumption that the fungus is not yet in Australia. WNS was added to Australia’s national list of notifiable animal diseases in 2019 and has been included in the top five native animal diseases in Australia’s priority list of exotic environmental pests and diseases. WNS response guidelines have been developed by Wildlife Health Australia.	

	Surveillance and biosecurity subgroups have been formed by the Recovery Team (see below for latest progress). <u>Current reporting period</u> An ARC Linkage grant application investigating WNS risk in Australian bats, led by Chris Turbill at Western Sydney University (with Lindy Lumsden and Jasmin Hufschmid from the RT as co-investigators) has been successful. Funding partners also includes Zoos Victoria and Wildlife Heath Australia. The research will include investigating winter activity, immune responses and other WNS related risk factors in Australian cave-dwelling bats, including the Southern Bent-wing Bat. A WNS risk review commenced in 2021. The process is being coordinated by DAWE, with input from members of the recovery team and other experts. The review includes a rapid risk assessment, and is considering new information that has become available since the first Australian risk assessment was undertaken in 2016 (see Holz et al. 2016, Holz et al. 2019). The surveillance subgroup has developed passive surveillance fact sheets to distribute to relevant stakeholders and community groups, to provide information for reporting possible disease in bats, including WNS, within the range of the SBWB. Targeted groups include vets, cavers, land managers and the general public. The fact sheets are near completion and will soon be distributed, including via veterinary networks, the ASF newsletters and networks, and the Recovery Team's SWIFFT webpage. A WNS procedure for Naracoorte Caves National Park has now been fully drafted by the Recovery Team's biosecurity subgroup (led by Renate Velzeboer, DEW). The aim is that this procedure can be then be used as a template for other sites. The document is currently undergoing consultation internally in DEW and has recently been reviewed by the wider Recovery Team. Feedback from this process will be incorporated into the final document. Further work is needed to continue surveillance for disease in the SBWB populations, as it is difficult to exclude the possibility of long-term impacts of minor diseases, episodic or epidemic disease events. Further surveillance is also needed to monitor for WNS. Possibilities for active disease surveillance are being considered by the surveillance subgroup.	
<u>Action 2.3</u> Determine survival rates	Survival analysis based on almost 3000 PIT-tagged bats from the Naracoorte population has been completed (van Harten 2020) and is in progress for publication. Lowest survival was in summer and autumn (particularly for juveniles and lactating females). Winter survival was high for all age and sex classes. Survival rates were markedly lower in summer and autumn of 2016, which corresponded with severe drought in the region (Emmi van Harten, La	

	Trobe University, with Thomas Prowse, Lindy Lumsden and Terry Reardon as co-supervisors). Survival rates for Victorian populations are still needed. Survival rates of pre-volant juveniles also remain unknown.	
Action 2.4 Assess breeding success	Prior to October 2020 Estimates of breeding success have been assessed by comparing estimates of pups and population counts of adults undertaken simultaneously, though there remains significant uncertainties around these estimates (see below and TSSC 2021). It was estimated that in 2020, approximately 39% of mature females gave birth at Warrnambool and 97% at Portland. The only simultaneous counts available for Bat Cave suggest that in 2003 approximately 54% of mature females gave birth to young. More information about these estimates can be found in the Conservation Advice (TSSC 2021) and the 2020 annual report. Current reporting period Nicola Bail (Masters student at Adelaide Uni supervised by Tom Prowse and Lindy Lumsden) has commenced a research project which aims to investigate pregnancy rates and breeding success of female SBWBs at Bat Cave. The ultrasound approach was piloted in September and found to be successful, and a larger number of females were processed in late September/October, with a high proportion found to be pregnant. It currently remains unknown why such a low proportion of reproductively mature females at the Warrnambool and Naracoorte maternity caves appear to be successfully breeding each year (as suggested by the current available estimates), and why this rate is so variable between maternity sites. It is possible that reproductive rates are impacted by the significant challenges in obtaining accurate pup counts due to the inaccessible locations of the creches in these caves (particularly at Warrnambool and Naracoorte) and the need to reduce disturbance. Further refinements of the techniques are required in future years. As stated at Action 2.3, the survival rates of juvenile bats between birth and the commencement of flying also remains unknown.	
Action 2.5 Determine maternity cave microclimatic conditions & water use	As reported in 2020, data on temperature and humidity is regularly being collected from the Warrnambool and Naracoorte maternity caves, as well as selected key non-breeding caves in Victoria and South Australia. This monitoring has partly continued in the current reporting period with some impacts from COVID restrictions in Victoria. Microclimate is no longer being monitored in the Victorian non-breeding caves. Unfortunately, due to the height of where the bats roost in the Warrnambool cave, the exact microclimate within the maternity roosting avens/bell-	

	holes remains unknown. The collected data is yet to be fully analysed.	
Action 2.6 Strategic survey of numbers, usage & seasonal patterns at non-breeding sites	Continued monitoring of population numbers is being undertaken at four key non-breeding caves in Victoria using fly-out counts, bat detectors set in caves and time-lapse infra-red cameras (Amanda Bush and Lindy Lumsden, ARI, and Yvonne Ingeme, DELWP). In this reporting period, this monitoring only occurred during summer 2020/2021 due to COVID restrictions at other times. Occasional summer monitoring of numbers was also undertaken at other less regularly used roosts. Amanda Bush and Lindy Lumsden also checked a number of roosting caves in the Otways region which haven't been surveyed for many years. Some appear to have been abandoned while others continue to be used in reasonable numbers. As reported at action 1.2, seasonal patterns of PIT-tagged bats in South Australia have been analysed, including at a key non-breeding cave (Emmi van Harten, Thomas Prowse, Terry Reardon and Lindy Lumsden). Continuous monitoring has occurred at this cave since 2017. A publication is forthcoming outlining the findings. There has also been short-term monitoring at a couple of other SA caves (Terry Reardon and Dennis Matthews).	
Action 2.7 Survey for additional unidentified roosts	Previous reporting period Extensive localised searching was undertaken by consultants for new caves in Victoria as part of a wind farm pre-construction assessment in areas that are some distance from known roosts but where high levels of Southern Bent-wing Bat activity were recorded on detectors. No new roosts were found. A previously unknown non-breeding cave was found near Naracoorte, South Australia by Steve Bourne.	
Action 2.8 Determine foraging availability	A GPS tracking study by Amanda Bush is investigating foraging patterns of SBWBs, including distances travelled, habitat use, consistency of movement patterns between nights and intercave movements in Victoria. The pilot study in 2020 was expanded in 2021, with data analysis now underway. Preliminary results suggest that while most foraging/movement patterns are in highly-cleared farmland, bats are disproportionately focusing on trees within these landscapes (including scattered trees, roadside vegetation and exotic plantings) and that some bats are flying distances exceeding 50 km away from the roost each night. (Amanda Bush and Tom Prowse, Adelaide Uni, and Lindy Lumsden, ARI). The first dietary study in the SBWB has demonstrated a prey preference for moths (Kuhne 2020), however prey	

	availability in the landscape remains unknown (see more below, Action 2.9)	
Action 2.9 Investigate diet	A dietary study was undertaken using DNA analysis of guano samples collected in autumn 2019 from key roosting caves in Victoria and SA (Johanna Kuhne, University of Adelaide, supervised by Tom Prowse). All samples comprised almost entirely Lepidoptera (moths) – many species of which were identified as having associations with farmland (Kuhne 2020). Further questions such as seasonal and geographic variability still need to be investigated.	
Action 2.10 Investigate impact of pesticides	As reported in the previous annual report, an investigation by Holz (2018) found similar results to previous studies, with pesticide levels assessed as unlikely to be contributing directly to the SBWB population decline, though there may be subclinical effects. Agricultural pesticides may also severely reduce the abundance of prey species, such as moths and their larvae. The impact of pesticides on the Southern Bent-wing Bat still requires further investigation.	
Action 2.11 Investigate impact of wind farms	Prior to October 2020 There has been a large degree of uncertainty in mortality estimates at windfarms, though a number of dead Southern Bent-wing Bats have been confirmed during post-construction mortality monitoring in Victoria (Moloney, Lumsden and Smales, 2019). A wind farm subgroup was formed by the Recovery Team upon establishment. The role of this subgroup is primarily advisory. Current reporting period Amanda Bush's tracking study in Victoria will investigate flight heights of SBWBs which will help to assess risk of collision with wind turbines (Adelaide Uni, supervised by Lindy Lumsden & Tom Prowse). Tracking was undertaken in summer-autumn 2021 (following the pilot study in 2020). Data is currently being analysed. The research also includes confirming/calibrating the accuracy of the height data through use of drones in SA, which will be undertaken in 2022. A Population Viability Analysis has been undertaken for the Victorian SBWB population by ARI to investigate the population level impact of mortalities from existing wind farms in Victoria and the likely cumulative impact from proposed wind farms. The Recovery Team was requested by DAWE and DELWP to provide advice and technical comments on the draft Southern Bent-wing Bat Adaptive Management Plan for Mount Fyans Wind Farm. Detailed comments were provided to the proponent. This was led by the wind farm subgroup.	

	Survey guidelines for bats (especially the SBWB) for informing wind farm assessments are being developed by DELWP. Pre-construction assessments and post-construction mortality monitoring continue to be undertaken by consultants in Victoria and assessed by DELWP and DAWE.	
Action 2.12 Determine suitable cave-gate design	Whilst there has been no species-specific progress on information about suitable cave gate designs for Southern Bent-wing Bats, research in New South Wales provides information on results for other subterranean bat species (Gonsalves et al. 2021). Long-term (2-20 years) bat response to cave-gating was monitored at derelict mines that are used as bat roosts. Emergence activity and minimum colony size were 7–10 times greater at adits with 'bat friendly' grating (horizontal bars with spacing >125 mm) than other gating treatments, however, almost all activity was by Eastern Horseshoe Bats. Circling at gates continued for many years and bent-wing bats (Eastern Bent-wing Bat and Little Bent-wing Bat) made little use of these sites. The authors concluded that bat-friendly gates appear to be an effective management option for Eastern Horseshoe Bats but that alternatives need to be trialled for other species, including bent-wing bat species.	
Action 2.13 Feasibility of an artificial maternity cave	No progress as this is considered a low priority action.	
Objective 3. Protect the maternity sites and other key non-breeding sites.		
Action 3.1 Active management to protect maternity sites	The Warrnambool maternity cave continues to now be actively managed specifically for conservation. Recently security cameras were installed inside the cave and at strategic positions on the surface of the site, trespassers photographed and various people spoken to, to increase security of the site and minimise disturbance. Other management activities have included removal of stock from the block over the cave to enable regeneration of native plants, erection of signs to deter visitation and disturbance, and working closely with neighbours to improve protection. A management plan is currently being finalised (Trust for Nature, Lindy Lumsden and Garry Peterson, DELWP). A project is underway to design a cover for the hole above one of the chambers in the Warrnambool maternity site to increase protection of the roosting habitat, improve the microclimate and reduce safety risks (Yvonne Ingeme, Garry Peterson, Amanda Bush, Lindy Lumsden, DELWP). This study will also provide guidelines for recapping of the cave roof if there is a collapse in the future. The maternity cave at Naracoorte is protected and actively managed for bat conservation and heritage value as part of the Naracoorte Caves National Park, World Heritage Area,	

	South Australia. Active management is ongoing (see Management practices). As in the previous reporting period, in early 2021 protective coverings were again applied to the fencing at Bat Cave during the breeding season to decrease injurious collisions in newly volant juveniles (Ingeme et al. 2018, Holz et al. 2019b). There is only limited access to the maternity cave near Portland due to the particulars of the site. No active management is currently thought necessary for this location.	
Action 3.2 Management plans for key non-breeding sites	A cave audit subgroup has been formed by the Recovery Team to undertake a cave audit of known SBWB roost sites in both states and determine the management actions required for each cave. In Victoria, Amanda Bush and Lindy Lumsden (ARI) continue to work closely with landholders of the key non-breeding caves to improve protection and decrease visitation to reduce disturbance. Vegetation has been cleared around the entrances of some non-breeding caves to keep flight paths open. Site sensitivity (including availability of site locations and information) and responsibility for management activities (such as managing vegetation at cave entrances) have been raised as issues needing resolution following the cave audit. Management requirements and recommendations will be negotiated on a site-by-site basis after the cave audit has been completed. Naracoorte Caves National Park has now ceased tours of the cave section in Blanche Cave that is used by SBWBs from 1 May to 31 August. During the winter of 2021, staff occasionally monitored presence of bats from the third roof window opening and SBWBs were determined to be present most times.	
Action 3.3 Control introduced predators	Naracoorte Caves National Park have reported continued monitoring and control of introduced pests as required. Incidental monitoring of introduced predators has been undertaken at the Victorian maternity and key non-breeding caves during the summer monitoring. There has been no evidence of unusual predation events (Lindy Lumsden and Amanda Bush, ARI).	
Action 3.4 Erect/maintain signs to limit cave access	As reported previously, generic ‘do not disturb’ signs were erected above and inside the Warrnambool maternity cave (Trust for Nature, Lindy Lumsden and Garry Peterson DELWP). Security cameras were also recently installed at the site. A ‘Cave Closed’ sign has been placed within one of Victoria’s key winter roost sites. Naracoorte Caves National Park have identified key sites for additional signage. Additional signage requirements are	

	also being discussed by the Recovery Team's disturbance subgroup as outlined at Action 3.7.	
Action 3.5 Provide information & advice for council planning processes	DELWP is providing advice to councils/Earth Resources (DJPR) in relation to a number of limestone quarry cases that are in relatively close proximity to known SBWB roost sites and/or foraging habitat. For some of these sites Geo Technical work is being requested to determine extent of caves and also hydrological investigation to determine the potential impact on adjacent wetland foraging habitat proposed by the quarry development (Yvonne Ingeme and Garry Peterson, DELWP). DELWP provided advice to a shire raising concern at a proposal to develop a walking trail in close proximity to a SBWB roost site (Yvonne Ingeme DELWP)	
Action 3.6 Provide information to state agencies for fire planning processes	Planning for prescribed burns at Naracoorte Cave NP have specific objectives around ensuring protection of the maternity cave. Prescribed burns at the national park were due to occur by the end of October 2022. Natural Values layers for fire response (SA) include known maternity and non-breeding cave sites (NPWS, DEW). In Victoria, planned burning planning is currently based on records within the Victorian Biodiversity Atlas. Mitigation measures have been developed such as consideration of wind direction and therefore smoke direction in relation to caves and not conducting earth works near caves. Review of threatened species mitigations for planned burning is in progress. This will allow for review and updating of operational and tactical mitigations for the SBWB (Garry Peterson and Yvonne Ingeme, DELWP). Advice has been provided on specific proposed burns near roosting caves in the Lower Glenelg area (Garry Peterson, Amanda Bush, Lindy Lumsden, DELWP).	
Action 3.7 Develop & promote a code of conduct for cave visits	The SBWB is highly susceptible to human disturbance at roosting caves (Bush et al. 2017). The Recovery Team has formed a disturbance subgroup to develop and promote a code of conduct for cave visits. The subgroup has met and has agreed to provide several different levels of information and advice (aimed at difference audiences) to minimise disturbance at roosts. These measures will include a detailed document about cave bat disturbance impacts and mitigation measures, a simplified fact sheet to give to groups and cave visitors, designs for signage at key caves and information for a webpage. Key caves will be identified for signage.	
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	The Lower Limestone Coast Water Allocation Plan (LLC WAP) provides policy for protecting wetland and creek Groundwater Dependent Ecosystems (GDEs) from groundwater extraction. Many wetlands important as	

	foraging habitat within the Naracoorte Ranges area are highly groundwater dependent, including permanent pools within Naracoorte Creek, and wetlands on the Mosquito Creek floodplain (including Bool and Hacks Lagoon). Significant loss of wetlands in the Naracoorte Ranges area has been attributed to groundwater level decline, as a result of both groundwater extraction and reduced rainfall (Harding et al. 2018). The 2019 Risk Assessment for the LLC WAP identified High Risks to GDEs in the Joanna Management area (which includes the Naracoorte Caves area and Mosquito Creek) from groundwater extraction. (Claire Harding, NPSW, DEW). Also see management practices below in relation to habitat overlays.	
Action 4.2 Restore & enhance foraging habitat	Ongoing work on the long-term restoration of Mount Burr Swamp, South Australia by Nature Glenelg Trust has continued, having purchased the property for biodiversity conservation in 2016. The property is within the vicinity of some key non-breeding caves in SA. Restoration included creating a weir preventing surface water flow out of the main wetland ensuing Mt Burr Swamp retains water (2016). Progressive revegetation continues, with high involvement with the local community. The SBWB has been captured at the property during a harp trapping survey in 2019 (conducted by Rose Thompson) and is presumed to forage at the site. As part of the management of the Warrnambool maternity site, the area above the cave is being monitored to assess the extent of natural regeneration of native coastal plants, with the aim of increasing foraging habitat (DELWP and Trust for Nature).	
Objective 5. Clarify the taxonomic status, distribution and population structure of the Southern Bent-wing Bat.		
Action 5.1 Clarify taxonomy	A full taxonomic revision of Indo-Australasian bent-wing bats has been undertaken by PhD student Sigit Wiantoro (University of Adelaide) using genome-scale DNA sequencing, traditional morphometric measurements and geometric morphometric analysis of skull models using micro-CT x-ray scans (Wiantoro and Armstrong 2019). The collection of new genetic material through Ophelie Planckaert's PhD (University of Melbourne, see below) supports these findings. Publication of results is expected soon.	
Action 5.2 Clarify extent of geographic range based on genetics	PhD student Ophelie Planckaert (University of Melbourne, supervised by Lindy Lumsden, Kyle Armstrong, Craig Nitschke and Patrick Baker) is investigating population genetics of Southern and Eastern Bent-wing Bats. Genetic samples have been collected from a number of sites throughout the Victorian range of both subspecies, including in the overlap zone, which will help clarify the respective geographic ranges. The project commenced in	

	the last reporting period and further sampling and analysis was undertaken in 2021. A total of 368 individuals were sampled and the genetic sequencing has been undertaken with analysis of the data now underway.	
Action 5.3 Develop field-ID tool to distinguish between Southern Bent-wing Bats & Eastern Bent-wing Bats	Ophelie Planckaert is also investigating the efficacy of using full spectrum acoustic analysis to improve the accuracy of call identification (Planckaert et al. 2020). Extensive collection of echolocation calls has been undertaken using high quality full spectrum detectors (with genetic samples taken from those individuals to ensure correct subspecific identification) from sites across the Victorian range of both the Southern and Eastern Bent-wing Bats (Lindy Lumsden and Amanda Bush assisting in data collection). Further sampling occurred in early 2021. ARI is currently developing a new approach for automating analysis of full spectrum calls using deep learning convoluted neural networks, that will be used for this project (Peter Griffioen, Lindy Lumsden and Amanda Bush ARI).	
Action 5.4 Improve understanding of population structure for informing recovery	Ophelie Planckaert's genetic study will improve understanding of the population structure of SBWBs. Genetic samples (wing tissue) have been collected from individuals from a number of sites throughout the Victorian range. Further collection and analysis has continued in 2021 (Lindy Lumsden and Amanda Bush assisting in data collection). Recent PIT-tagging data at the Naracoorte maternity cave show that a very high proportion of individuals return each year to their natal cave for the maternity season. This suggests discrete populations may be operating at some level. Recent studies (PIT-tagging by Emmi van Harten and tracking by Amanda Bush) show that Southern Bent-wing Bats readily commute long distances, however it is currently not known how much interchange there is between the populations centred on the three maternity caves. A large number of individuals were trapped exiting caves in Victoria as part of Amanda's study, when trying to retrieve transmitters. These individuals were scanned for PIT-tags from Emmi's study at South Australia to see if any of these individuals were currently in Victoria. No PIT-tagged individuals were found. Further investigations are required to examine both short-term mixing between populations, and longer-term mixing as reflected in genetic population structure.	
Objective 6. Compile and maintain databases to aid in the management of the subspecies.		
Action 6.1 Compile, maintain & assess information on roost sites	A cave audit subgroup has been formed by the Recovery Team to compile information and assess management requirements at SBWB roosting caves. Many of the known caves have now been visited and a database is continuing to be compiled and populated.	

Action 6.2 Develop a project register	A research priorities subgroup was formed by the Recovery Team to prioritise research actions and projects required. Research and monitoring actions in the draft Recovery Plan have been collated (including some new proposed actions) and individually prioritised by each subgroup member. Actions were ranked in regard to priority and urgency (High, Medium, Low). These results have now been compiled and ranked based on the overall score across the whole subgroup. This process highlighted 10 actions that were clearly assessed as highest priority. These actions are now being summarised into a research prospectus, following input from the Recovery Team for the preferred format. Once this has been completed, the wider Recovery Team provide further comment on the research questions and priorities, to refine the document before distribution to research institutions and other organisations. A project register has not yet been developed.	
Objective 7. Establish a long-term monitoring program for the Southern Bent-wing Bat.		
Action 7.1 Design & implement monitoring program with an adaptive management framework	Long-term monitoring is being undertaken at the Warrnambool maternity cave and key non-breeding caves in Victoria. The installation of the new technology for detailed monitoring at Bat Cave in South Australia is expected to be complete and running by the first quarter of 2022. These programs can feed into an overarching long-term monitoring program within an adaptive management framework.	
Objective 8. Facilitate and promote community interest, understanding and participation.		
Action 8.1 Develop & implement communication plan	A communication plan is yet to be developed. The Recovery Team has highlighted the development of a SBWB communication plan as a high priority for the next reporting period (2021–2022), with a new communications subgroup being formed in October 2021. In 2020, a Recovery Team webpage was created in conjunction with SWIFFT at https://www.swifft.net.au/cb_pages/team_southern_bent-wing_bat_-_recovery_team.php. This webpage can be further developed/populated as a communication resource as the Recovery Team and communication plan is further established. Some updates have been made to the page in 2021, including revisions now that the Recovery Plan has been endorsed and links to the new Conservation Advice. The specific communication activities outlined in the Recovery Plan as part of Actions 8.2–8.5 will be incorporated into the overarching communication plan.	
Action 8.2 Change perceptions of	Although not specific to the SBWB (as SBWB are not known to use non-cave roost locations), the LCLB developed a ‘How to build a bat box’ brochure in conjunction with the Naracoorte Men’s Shed. The brochure	

landholders about pesticide use	includes information on benefits of bats and threats including pesticides. A short video was also developed, which practically demonstrates how to build a bat box. LCLB provided grant funding to Mary Retallack of Ecovineyards to deliver a program promoting viticulture practices to increase habitat for bats and pollinators. The Grassroots Grant funding will enable the program to expand in the Limestone Coast. In February 2021, a bat citizen science activity was held at Mt Burr Swamp. The event included UV light trapping, bat trapping (unfortunately no bats were trapped on the night) and discussion around the role of bats in the ecosystem. There were 16 participants, with the target group being landholders. However, LCLB reported that more work is needed to attract this demographic (Limestone Coast Landscape Board and NGT).	
Action 8.3 Maintain & strengthen relationships with community organisations	LCLB worked with NGT (Rose Thompson) and Friends of Naracoorte Caves to deliver a community Bat Night event in November 2020 at the Naracoorte Caves, featuring SBWB and focusing on benefits of bats in an agricultural landscape. Naracoorte Caves (Tom Shortt) also spoke to attendees in the Bat Centre for an hour about the SBWB as part of the free event. As reported previously, members of local caving groups are involved in the Recovery Team and subgroups, including assisting with undertaking the cave audit. Naracoorte Caves National Park maintains a strong relationship with Friends of Naracoorte Caves – the Friends group has assisted with SBWB activities in previous years, including with Bat Night events. Several Team members have attended and presented at recent Australasian Bat Society conferences and are active members of the society. Presentations have also been given at national and international speleological conferences and caving clubs and an article on SBWBs was published in the Australian Speleological Federation magazine.	
Action 8.4 Increase community participation in revegetation of foraging habitat & cave protection & restoration	As per Action 4.2 above regarding community participation in restoration at Mt Burr Swamp Restoration Reserve.	
Action 8.5 Develop closer links with indigenous groups	Consultation with respective First Nations groups occurred during the initial drafting and development of the National Recovery Plan in 2009/10 (DELWP 2020). Since the establishment of the Recovery Team, renewed contact is gradually being made through existing relationships between Recovery Team partners (state agencies and NGT) and Traditional Owners. Some Traditional Owners	

	have been able to be contacted to provide an update on SBWB conservation and to reconfirm the level of involvement that is wanted with the Recovery Team. NGT will soon be meeting with South East Aboriginal Focus Group (SEAFG), Traditional Custodians of the SBWB range in SA. Gunditjamara (Gunditj Mirring Traditional Owners Aboriginal Corporation) is interested to receive major updates/correspondence from the Recovery Team. Emmi sent the 2020 annual report to update them on what has been undertaken so far. As part of an exchange occurring with DELWP and Eastern Maar (Eastern Maar Aboriginal Corporation), members of Eastern Maar will visit the Warrnambool maternity site during summer monitoring in the coming months, and have been invited to attend Recovery Team meetings. Engagement with Boandik descendants has occurred and fostered through education activities at Mt Burr Swamp, South Australia.	
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	The National Recovery Team was formed in October 2019 including a variety of members from state and Commonwealth departments/agencies, non-government organisations, zoos, caving groups and species experts from various universities and research institutions. Team membership, subgroups and Terms of Reference were reviewed in July 2021. The Recovery Team is highly collaborative and inclusive of all organisations and individuals interested in the recovery of the SBWB.	🟢
Action 9.2 Conduct a mid-term review of the Recovery Plan	Not due for another 18 months.	🔴
Action 9.3 Review implementation of the Recovery Plan & re-assess status of subspecies after five years	Not due for another 4 years.	🔴
Management practices (status not listed as these practices are ongoing)		
Parks & reserves with roosting caves: Closer monitoring of population numbers. Monitoring &	Naracoorte Caves National Park, South Australia, actively manages caves used by the SBWB in the Park. Thomas Shortt (Naracoorte Caves, DEW) reported that recent management activity has included pest and weed control, maintaining cave entrances, daily monitoring of the SBWB population in Bat Cave via the cameras, and providing assistance/support for the Bat Cave monitoring program	

reducing impacts from human disturbance, predation by introduced predators & encroachment by weeds	being established. Minimising human disturbance is a key priority. Monitoring of Victorian caves is outlined under specific actions above.	
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	In 2020, Recovery Team members had input into the Victorian species Habitat Distribution Model for Southern Bent-wing Bats so that key areas of roosting and foraging habitat are highlighted (Yvonne Ingeme, Lindy Lumsden and Amanda Bush, DELWP).	
Planned burning should be undertaken in such a way as to minimise impact on foraging habitat	Prescribed burns (<20ha) are planned within the Naracoorte Caves National Park for spring 2021. The environmental assessments for these burns will consider risks to key foraging habitat for the Southern Bent-wing Bat (Claire Harding, NPWS).	
Aim to increase the amount of foraging habitat in the vicinity of key roost sites	See Action 4.2.	
Strictly enforce restrictions on items capable of carrying the fungus that causes WNS	Additional directions regarding WNS and equipment have been added to scientific and recreational caving permits issued at Naracoorte Caves National Park. Post code data (Australia) and country of origin (international) are collected when visitors purchase cave entry tickets at the National Park. As recorded at Action 2.2, a biosecurity procedure has also been drafted for Naracoorte Caves NP. A WNS risk review is currently underway, coordinated by the Department of Agriculture, Water and the Environment (see Action 2.2). Australian Speleological Federation is maintaining a strong position on WNS and decontamination protocols amongst cavers in Australia. However, recently-published research on knowledge and attitudes among cavers suggests that more work may be needed (Salleh et al. 2021): 'Although 65.9% of respondents were aware of current	

	decontamination protocols, only 23.9% and 31.2% (when in Australian or overseas caves, respectively) fully adhered to them. Overall, cavers showed strong willingness to help prevent further spread of this disease, but further efforts at education and targeted biosecurity activities may be urgently needed to prevent the spread of *P. destructans* to Australia and to other unaffected regions of the world.'	
Liaison with indigenous groups over the management of caves with cultural heritage values		
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	In Victoria, DELWP continue to have input into planning processes around wind farms to ensure rigorous assessments and monitoring. Also see Action 2.11.	

4. TRACKING CHANGES IN THE STATE/ CONDITION AND CONSERVATION TRAJECTORY

Summary state in 2020	
Abundance	In 2020, the total Southern Bent-wing Bat population was estimated to be 44,260 reproductively-mature individuals. At Naracoorte, a November 2020 count estimated 30,500 (including individuals not reproductively mature). However, PIT-tag data suggests that this count was undertaken prior to peak occupancy. It was estimated that the population range was between 30,000–35,000. The 2020 population estimate (including juveniles) for Warrnambool was 16,000–18,000, and for Portland was 1000–1500 individuals.
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: Bat Cave, which lies within the Naracoorte Caves National Park in South Australia and a sea cliff 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 windfarms, fire, and accumulation of pesticides or other toxins.
Current known state	
Abundance	Approximately 32,000 individuals at Bat Cave in December 2020 (estimated peak occupancy and before juveniles become volant), though this includes individuals that have not reached reproductive maturity. Population counts were undertaken in Victoria for the 2020/21 season, but processing and analysis of the data is still underway.
Distribution	As above
Threats	As above
What is the current state/condition and conservation trajectory?	
In 2020, the Recovery Team developed PVA models that predict that there will be further significant decline in population numbers, in the order of 84% to 97% from 2020 to 2056. These assessments have been made with the best available data on the Southern Bent-wing Bat to date (matching the category outlined in Appendix 1 – adequate high-quality	

evidence and high level of consensus), and hence the conservation trajectory has been assessed as 'Deteriorating', and the State 'Very poor'. However, as identified knowledge gaps are filled, we will be able to tighten modelling assumptions to further increase accuracy of predictions in the future. Despite this uncertainty, these predictions are extremely concerning and suggest that there is a high risk of extinction for the Southern Bent-wing Bat within just decades.

Population trends for each maternity population

Current available data from fly-out counts at Bat Cave and population projections based on survival rates at this site, suggest that the population is in a current and ongoing state of decline (van Harten 2020, TSSC 2021). The new monitoring program at Bat Cave will enable regular, accurate population counts to be undertaken across seasons and between years to accurately monitor trends into the future.

Survival rates used for recent population modelling (predicting severe decline) were estimated from the South Australian population, and it is possible that survival rates differ between the maternity populations. It is difficult to compare population fly-out counts at Warrnambool over the last two decades due to the different counting methods. Counts in the early 2000s were as low as 10,000, however, as stated in the Conservation Advice (TSSC 2021), 'recent attempts to replicate the manual counting method from the early 2000s resulted in less than a third of the count obtained using the current approach on the same night (the manual counting approach recorded approximately 6,000 bats, while the thermal camera technique recorded approximately 18,000 individuals (A. Bush and L. Lumsden pers. comm. 2020)'. Therefore, it appears likely that there has been a genuine and ongoing decline in numbers in Victoria over the last two decades.

Population trends at Portland cannot yet be estimated due to the recent discovery of the site.

Summary

The Southern Bent-wing Bat was listed nationally as Critically Endangered under the EPBC Act in 2007 due to severe population declines and dependence on just two known maternity caves (this was prior to the discovery of the third maternity cave near Portland). Currently there is no evidence to suggest that the past declines of the Southern Bent-wing Bat populations have ceased as numbers have continued to decline over the decade. Key developments in knowledge include new information about survival rates of the Southern Bent-wing Bat in the South Australian population from 2016–2019 (van Harten 2020). Lowest survival coincided with severe drought conditions in the region in 2016. Combined with the results from efforts to increase accuracy of population monitoring and undertaking pup counts, population viability models could be developed to predict the future trajectory of the Southern Bent-wing Bat for the first time. The risks of White-nose Syndrome and impact from drought events were also included in the models. Two models were developed (a conservative and less conservative model) predicting population decline of 84% to 97% from 2020 to 2056 (i.e. over three generations). More information about this assessment can now be found in the Conservation Advice (TSSC 2021) and trend predictions from the Appendix to the Conservation Advice are reproduced below (Figure 1). While threats contributing to the past decline are known to some extent, the relative magnitude of each contributing factor is not fully understood. While many of the actions from the Recovery Plan have been at least partially implemented and we have greater knowledge on population trends and some threats, further implementation of the plan is needed to improve the current trajectory of the Southern Bent-wing Bat.

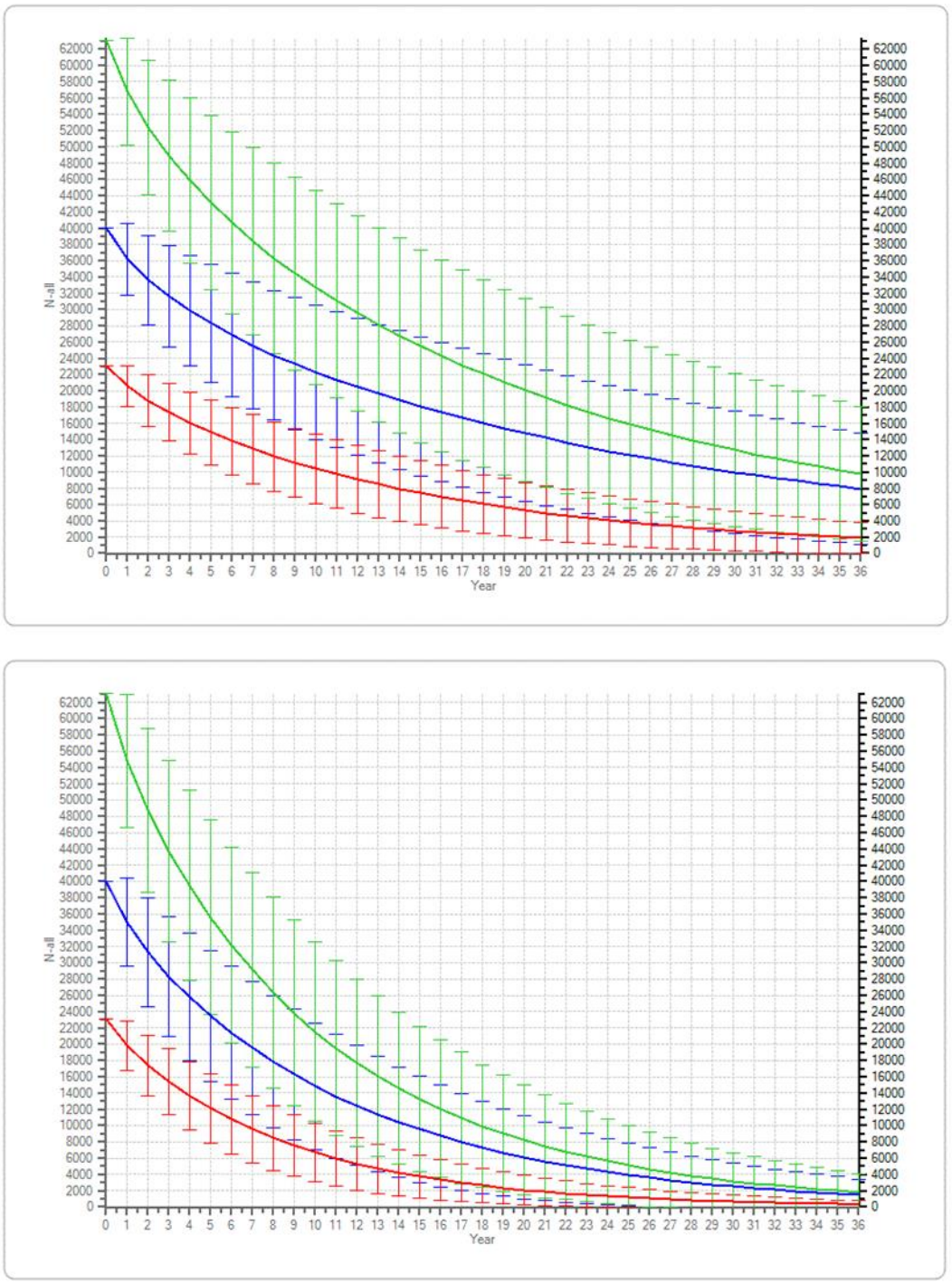


Figure 1. Population curves produced by the Recovery Team for Victoria (red), South Australia (blue), and the total population (green) for the conservative model (top) and less conservative model (bottom). Bars represent the standard deviation of the mean. Further information available in the Appendix 1 of the Conservation Advice (TSSC 2021).

5. SUPPORTING INFORMATION

Recovery Team Report

In the previous 12-months, the Southern Bent-wing Bat National Recovery Team has had four remote meetings to discuss progress and issues relating to recovery of the Southern Bent-wing Bat. Several subgroups continue work on specific tasks identified by the Recovery Team and the guiding National Recovery Plan, which was formally adopted in November 2020.

Funding from DELWP enabled the continuation of the coordinator position for the Recovery Team until early 2022. The position continues to be hosted by Zoos Victoria. The Team has identified the coordinator role as essential to the Team's function. Securing continued funding for the position will be integral in maintaining the Team's progress, and for supporting recovery of the SBWB. Responsibilities of the coordinator include:

- facilitating communication within, and on behalf of, the Recovery Team, and its network and external stakeholders
- coordinating delivery of Team priorities and responsibilities
- organising meetings, preparing agendas, compiling progress reports, drafting and circulating minutes
- writing and review of Team documents, advice and the annual report, and coordinating Team input into these documents
- application and renewal of permits for SA monitoring activities and other administrative tasks that arise.

A major task in 2020 was providing advice for the reassessment of the Southern Bent-wing Bat's threatened status and conservation actions under the Commonwealth EPBC Act. The Recovery Team's advice has now been accepted by the Threatened Species Scientific Committee and took affect under the EPBC Act on 14 June 2021. The Conservation Advice (TSSC 2021) retains the Southern Bent-wing Bat's threatened status at Critically Endangered and provides up-to-date advice on the latest knowledge on the species' ecology, population trends and threats.

As outlined in Section 2, considerable progress has been made towards a number of monitoring/research actions and management practices outlined in the National Recovery Plan. Through the support of DELWP, a Specific Needs assessment in underway with the Recovery Team and its broader network to prioritise actions that are likely to be most effective in conserving the Southern Bent-wing Bat (across both the South Australian and Victorian range) over the next 50 years. Moving forward, securing funding will be a major driver in ongoing and successful implementation of the Recovery Plan to meet the long-term recovery objective 'to ensure that the Southern Bent-wing Bat can survive, flourish and retain its potential for evolutionary development in the wild'. It is envisioned that the outcomes of the Specific Needs assessment will help guide such investment decisions.

Future course of action

The National Recovery Team recommends ongoing implementation of the National Recovery Plan, using the Specific Needs assessment to help prioritise and refine these actions. While there have been significant improvements to the security and management of some key roosting sites, most of the other activities to-date has been to clarify population trends and investigate threats. Adaptive management will be critical as new knowledge is obtained and management actions are further refined and implemented, and new actions developed where needed. The highly collaborative approach of all individuals and organisations involved in the Recovery Team, has been a key to the success of this

team and the significant progress that has been made in implementing the Recovery Plan. This successful, effective approach will continue into the future.

Information sources

Recovery Plan

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Conservation Advice

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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