SWIFFT State Wide Integrated Flora and Fauna Teams

SWIFFT Video conference notes 26 July 2012
Bat ecology and conservation

SWIFFT meeting notes are a summary of the video conference and not intended to be a definitive record of presentations made and issues discussed.

KEY POINTS SUMMARY

Insectivorous bats consume at least half their body weight in insects per night when feeding. They are one of nature's natural pest controllers and can play an important role in reducing agricultural pests.

The loss of habitat, particularly big old tree and loss of tree hollows is a major threat to insectivorous bats – the less big old trees the less bats.

Insectivorous enter state of torpor (May – September), disturbance to bats in torpor can have a significant impact on their ability to survive.

The Southern Bent-wing Bat population at Naracoorte has suffered a 67% reduction over three generations. Insecticides, drought and land use change all being contributing factors.

Thermal imaging cameras, laser beam technology and radar tracking systems are now being used to monitor bats.

There is high variability in cave use by bats which means non-intrusive monitoring must be carried out regularly throughout the year, over multiple years.

It has been difficult to determine the impact of windfarms on Southern Bent-wing Bats because there have been limited requirements on operators to search for mortalities and report findings.

The third video conference for 2012 had a total of 90 participants connected across 16 locations; Mt Gambier, Hamilton, Colac, Warrnambool, Ararat, Heywood, Ballarat, Bendigo, Benalla, Tatura, Wodonga, Geelong, Traralgon, Bairnsdale, Box Hill, and Nicholson Street Melbourne.

Those attending included participants from;
Educational: University of Ballarat, Melbourne University.

Local Government: Nil.

Field Naturalist Clubs: Ballarat, Ararat, Geelong, Hamilton, Portland.

Community Conservation Groups: Friends of Eastern Otways, Barwon Coast Committee, Ararat Landcare, Basalt to Bay Landcare, Torquay Landcare, Naracoorte Landcare, Avoca Landcare.

Conservation Organisations: Barwon Coast Committee, Western Coastal Board, Nature Glenelg Trust, Windamarra Aboriginal Corp., Parks Victoria, Goulburn Broken CMA, Trust for Nature, Dept. Primary Industries Victoria and Dept. of Sustainability and Environment biodiversity staff across 15 locations. Also at Mt Gambier staff from the Dept. Primary industries South Australia, Dept. of Environment, Water and Natural Resources South Australia.

Industry related: Borderwatch newspaper, Biosis Research, WSP Group, Consultants from Bairnsdale.

SPEAKER SUMMARIES

Insectivorous bats of Victoria and south-eastern South Australia; bat ecology, conservation status and threats *- Dr Lindy Lumsden, Senior Scientist, Wildlife Ecology, Dept. of Sustainability and Environment, Arthur Rylah Institute, Heidelberg.*

Lindy introduced her talk by saying bats are not like the mysterious blood thirsty vampires portrayed in movies – they are in fact cute, friendly creatures and the only mammals capable of true flight. There are no introduced species of bats in Australia and they play an important role in the environment.

Flying Foxes

These are the most recognisable type of bats and most well known to the general public. The species which occurs in Victoria and south-eastern South Australia is the Grey-headed Flying-fox or Fruit Bat with a range extending from South Australia to south-eastern Queensland. The name flying fox is derived from the shape of their face but they are not related to foxes in any way and are not vermin. They are a native specie, listed as vulnerable, have a diet of fruits and nectar and are beneficial to the environment. Observations indicate their distribution has extended more southerly in recent years. They are highly migratory, travelling over 1000 km to source food.

Insectivorous bats

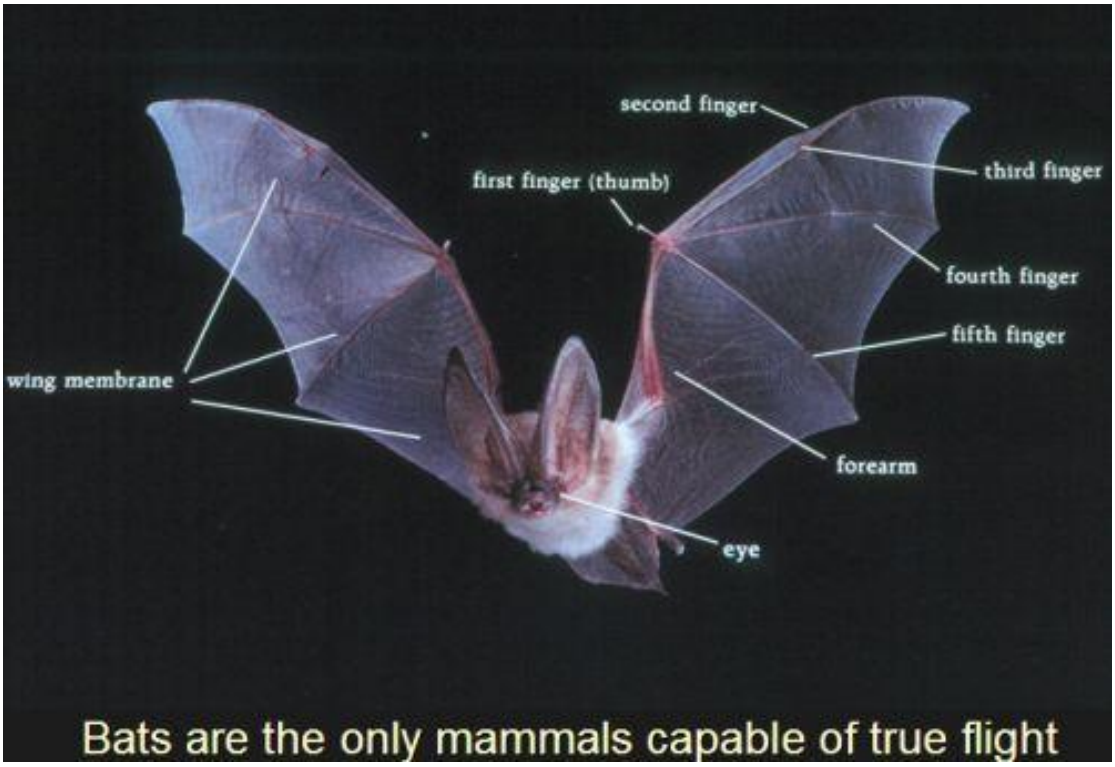
These are the most abundant species of bats. There are 16 species in south-west Victoria and south-eastern South Australia. Insectivorous bats are generally tiny; they are sometimes referred to as microbats. People are not usually aware of their presence due to their nocturnal behaviour and their ultrasonic calls which are inaudible to the human ear.

The insectivorous bats are quite diverse; there are a range of shapes and sizes and they occupy a diverse range of habitats and can have very specific ecological requirements.

Lindy spoke about the Little Forest Bat which weighs less than a 10 cent piece and is not much larger than a thumb nail. It is a species that would most likely be flying over peoples homes in the summer months feeding on insects such as mosquitoes. She also mentioned the long-eared group of bats which have distinctively long ears and the free tail group of bats which have an obvious tail.

Modified skeleton for flight

Lindy spoke about the structure of a bat wing which is a modified arm and hand to form a wing. Similar to other mammals like humans there is an upper arm, elbow, forearm, wrist and fingers including a thumb. These have evolved to support a wing membrane enabling flight.

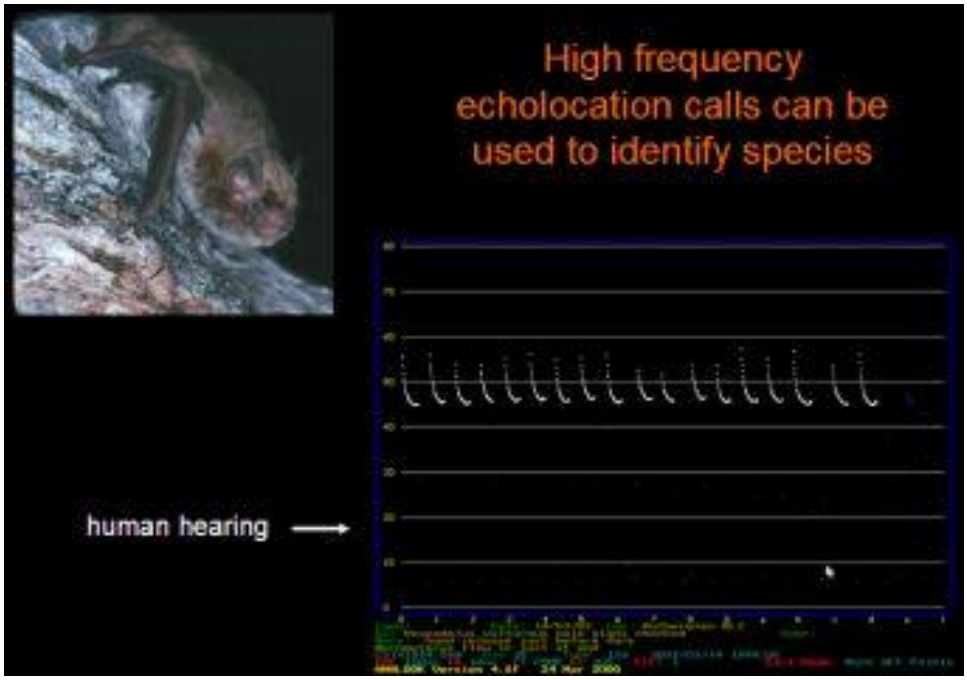


Some species such as the long-eared bats have relatively short but broad wing-spans enabling highly manoeuvrable flight in amongst trees whilst other species such as the White-striped Freetail Bat have a long wing-span for higher altitude feeding above the forest canopy.

White-striped Freetail Bat with long wings for high flight and an obvious tail.

Echolocation

Bats have an ability to produce high frequency sounds from their voice box which is emitted through their mouth. As the sound or echo is bounced back from objects it provides them with a clear picture of their surroundings (like a radar or sonar).



Bat calls are displayed as various shapes, frequency levels and time intervals to determine species.

Lindy pointed out that bats also use their eyesight to locate objects. She said the Grey-headed flying-fox has excellent eyesight. Echolocation is used to identify small or fine detail objects such as insects. We don't usually hear bats because the human hearing range is around 15 kHz whereas the bats high frequency call is 30-70 kHz well beyond our hearing range. The White-striped Freetail Bat is one species that can be heard by the human ear because its frequency range is 11 kHz.

Bat detectors

This equipment is used to record the presence of bats and determine the species by recording high frequency sounds. The equipment adjusts the frequency so it is audible to the human ear. Traces of the sounds can be visually displayed. Analysts can view the shape of the call, sound frequency and call interval to determine the species present.

Bats are a farmers friend

Bats consume at least half their body weight in insects per night when feeding. They are one of nature's natural pest controllers and have been recorded feeding on insect pests to primary producers. The composition of insects consumed by bats varies between species. Lindy showed some pie charts of the groups of insects consumed by bats on the Northern Plains in Victoria.

The Lesser Long-eared Bat has been recorded to consume mostly moths with crickets and bugs forming part of the diet.

The Little Forest Bat was found to consume bugs, beetles, moths, ants, flies and mosquitoes. The Chocolate Wattled Bat has been recorded feeding almost entirely on moths. The Southern Freetail Bat has been recorded feeding on bugs, ants, flies and mosquitoes. The Southern Myotis feeds exclusively over water on insects and small fish.

Torpor

During winter when insect numbers are low and the food supply is reduced bats seek shelter and go into a state of torpor to reduce their consumption of energy. Torpor is a mild form of hibernation but different in that it is controlled by the bat, the heart rate is lowered, the body temperature is lowered and breathing rate significantly reduced, all combining to reduce energy consumption. If disturbed, bats can come out of torpor but use up valuable energy reserves which cannot be readily replaced, in effect starving them to death.

Roosting

Most species roost in tree hollows; some are specialists requiring dead trees, others only roost in live trees containing spouts. The female Lesser Long-eared Bat only roots in large cracks in dead trees to give birth. The Southern Bent-wing Bat only roosts in caves and although they are found across south-west Victoria and south-eastern South Australia there is only one cave in Victoria and one in South Australia where they go to give birth.

Old paddock trees provide valuable habitat for many species of bats, some species will use cracks in the tree or under the bark whilst other species will use hollows or dead spouts. Some species will even use cracks in old fence posts where there is a shortage of natural roosting habitat.

Buildings are sometimes used by insectivorous bats for roosting; they do not cause structural problems and do not eat through wiring etc. Generally their presence in eating insects outweighs any problems.

Conservation status of microbats known from south-west Victoria and south-eastern South Australia

Lindy explained that in general bats have not experienced the same levels of extinction since European settlement compared to other Australian native terrestrial mammals. Several species of bats are not on the threatened species list which is good but continued loss of habitat and changes in the environment could alter their status.

Species	**Scientific name**	**Status Victoria**	**Status South Aust.**
Gould's Wattled Bat	*Chalinolobus gouldii*		
Chocolate Wattled Bat	*Chalinolobus morio*		
Eastern False Pipistrelle	*Falsistrellus tasmaniensis*		Endangered
Southern Bent-wing Bat	*Miniopterus schreibersii bassanii*	Critically Endangered	Endangered
Eastern Bent-wing Bat	*Miniopterus schreibersii oceanensis*	Vulnerable	
Large-footed Myotis	*Myotis macropus*		Endangered
Lesser Long-eared Bat	*Nyctophilus geoffroyi*		
Gould's Long-eared Bat	*Nyctophilus gouldi*		Endangered
Inland Broad-nosed Bat	*Scotorepens balstoni*		
Large Forest Bat	*Vespadelus darlingtoni*		
Southern Forest Bat	*Vespadelus regulus*		
Little Forest Bat	*Vespadelus vulturnus*		
Yellow-bellied Sheathtail Bat	*Saccolaimus flaviventris*	Data Deficient	Rare
Southern Freetail Bat	*Mormopterus* sp. (sp. 4)		
Eastern Freetail Bat	*Mormopterus* sp. (sp. 2)		
White-striped Freetail Bat	*Tadarida australis*		

Threats to bats

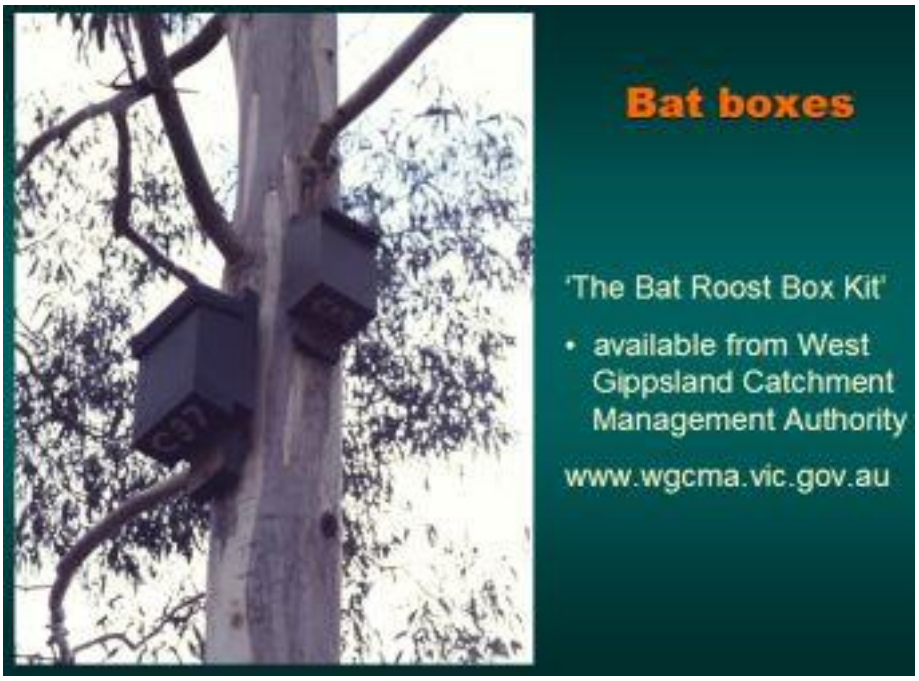
Lindy considers the loss of habitat, particularly big old tree and loss of tree hollows to be a major threat – the less big old trees the less bats. Other threats include;
landuse changes

- pesticides
- disease
- disturbance to roosting sites
- environmental impacts and climate change (loss of wetlands)

- introduced predators
- conflict with humans – public attitudes, people need to appreciate the bat fauna that we have.

Many landholders do not realise the bat fauna they have on their properties, the value of old habitat trees and the role bats can play in reducing agricultural pests on their properties.

Bat boxes



These can be used to provide additional roosting sites where big old trees have been lost in the environment or in areas where there has been regeneration but trees have not yet reached maturity to form natural hollows.

Key points from questions

- Bats call at about 120 db. Lindy said their call is very loud and it is just as well we can't hear them.
- Fuel reduction burning should be avoided from May to September when bats are in torpor. Disturbance during this state will have a significant impact on their ability to survive. Autumn is possibly the season when least impacts would be realised from fuel reduction burning.
- Torpor can be regulated by bats. They prefer a cool site to go into torpor which helps them maintain low a body temperature which can be reduced from 40⁰ to 10⁰ C. When they come out of torpor they rely on the stored body fats to provide energy for feeding. If the stored body fats are used up due to disturbance over winter they can starve because they will not have enough energy to feed.

Contact: Lindy Lumsden, Arthur Rylah Institute, Heidelberg 03 94508600

Southern Bent-wing Bat habitat, population decline and threats -

Steve Bourne, formerly DENR South Australia, currently Director of Planning and Environment, Naracoorte – Lucindale Council

Steve has been living near the bat caves at Naracoorte and observing the Southern Bent-wing Bat for 20 years. He was manager of the Naracoorte caves for 10 years and co-ordinated research into the Southern Bent-wing Bat.

Bat cave at Naracoorte. Each August to September thousands of Southern Bent-wing Bats find their way back to the cave to give birth, raise their young and mate. Some flying hundreds of kilometres to find the small cave opening.

Steve said the Naracoorte Bat Cave is the largest of two known maternity sites for the Southern Bent-wing Bat *Miniopterus schreibersii bassanii*. The bat cave has been the focus for many studies but even as some questions about their ecology have been answered there is still much research to do.

Population decline

Steve explained the difficulties in estimating the population decline due to the variations in counts over the years. In the 1960's the population was estimated at 100,000 bats declining to less than 30,000 in recent counts. Steve has tried to work out when the decline occurred. He has been involved in determining more accurate ways of counting bats at the cave. It has been realised that counting only at the Bat Cave is not a true reflection of the entire population as not all bats are in the maternity cave in summer.

Droughts and other adverse environmental factors can result in disease, causing mass mortalities.

Threats from pesticides

Steve spoke about a decline in the invertebrate fauna at the Bat Cave in the late 1990's. He remembers going into the cave in the 90's; the micro climate inside the cave was humid and the floor of the cave was teaming with invertebrate life comprising thousands of cockroaches which feed on the guano from the bats. By 2000 the cockroaches had disappeared which also coincided with a decline in the bat population. The decline was reported in a paper by Hamilton-Smith (2000). Further studies into the invertebrate fauna of the cave were conducted by Moulds and Bellati (2003).

Studies into the chemical residue in guano and bats were reported by Mispagel, Allinson, Allinson, Iseki, Grant, Morita (2004) [http://www.ncbi.nlm.nih.gov/pubmed/15051369] . DDT and metabolites were found to be present in bat tissues and transferred through milk from adult to infant. It was surprising to still find DDT in the ecosystem even after 30 years since it was last used in the region.

Steve said it was not clear that the current level of DDT would have a detrimental impact on the bats but there was a strong suspicion that a chemical used in potato production called Methamidophos could have been a problem as traces of this chemical were found in the bats guano. Being an insecticide it could have lead to a decline in the cockroaches which were feeding on the guano and altered the composting of the guano and the micro climate in the cave. Fortunately 2 years after the initial study no traces of Methamidophos were found in the guano and there has been an increase in the invertebrates on the floor of the cave.

Steve said the Australian Pesticides and Medical Veterinary Authority recently issued a statement which included; that on 15 June 2012, all approvals of the active constituent methamidophos were cancelled at the request of the approval holder.

- http://apvma.gov.au/node/12601

Threats – changing land use

Steve said large scale clearing of native vegetation and the introduction of pest species has severely impacted upon our native mammalian fauna. Cave dependant bats like the Southern Bent-wing Bat have suffered from damage to bat caves through rubbish dumping, changes to water regimes and human disturbance. Land use change from open grazing to more intensive farming, and cropping has altered drainage patterns, wetlands and removed native vegetation.

Threats – disease and drought

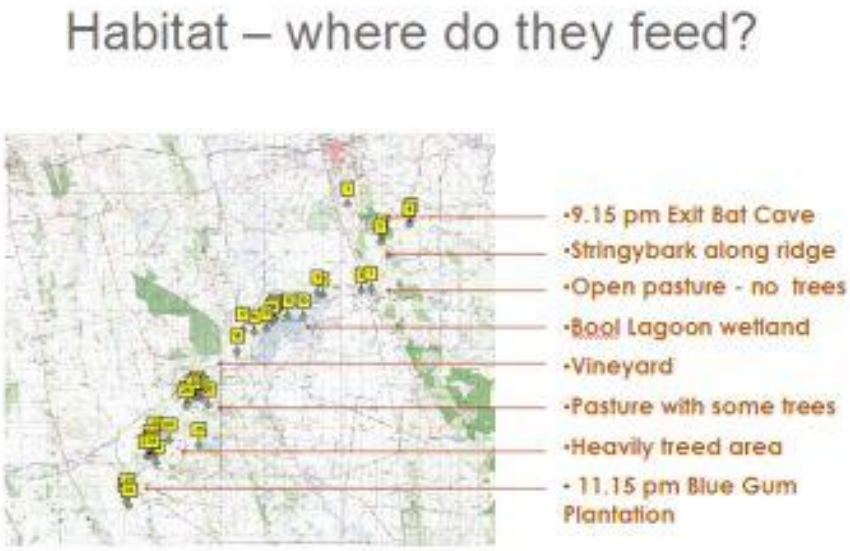
Droughts tend to reduce food supply for bats and they become more susceptible to disease. Steve spoke about three poor years of recruitment in the Naracoorte Bat Cave. In 2006 it was the driest year on record with no water seeping into the cave to raise humidity. There was a cold snap in December which coincided with birth of pups. The recruitment was poor with many 100's of pups dead in the cave. In 2008 rainfall was low and there was poor recruitment. A disease spread through the cave and many young bats were left dead hanging in the cave. In October 2009 white ulcers were observed on bats. A pox virus and parasite *Riouxgolvania beveridgei* was identified. This virus has not been since.

Ongoing threats

- Wind farms?
- More changes to land use and further intensification of industry?
- Climate change?
- Unfavourable weather conditions – note impacts of drought, cold weather in combination
- Changes to conditions in maternity cave – temperature, humidity?

Tracking bats

Steve spoke about two projects designed to track the movement of bats. Steve explained that tracking is very difficult and expensive as a plane is required to get above them. Results from the tracking of a single bat fitted with a transmitter found it left the bat cave at the same time on two consecutive nights and followed the same flight path visiting specific features in the landscape, venturing 45 km from the cave before returning.



Tracking of a Southern Bent-wing Bat. The same bat exited the cave at the same time over two consecutive nights venturing 45 km from the cave covering an almost identical flight path.

Key points from questions

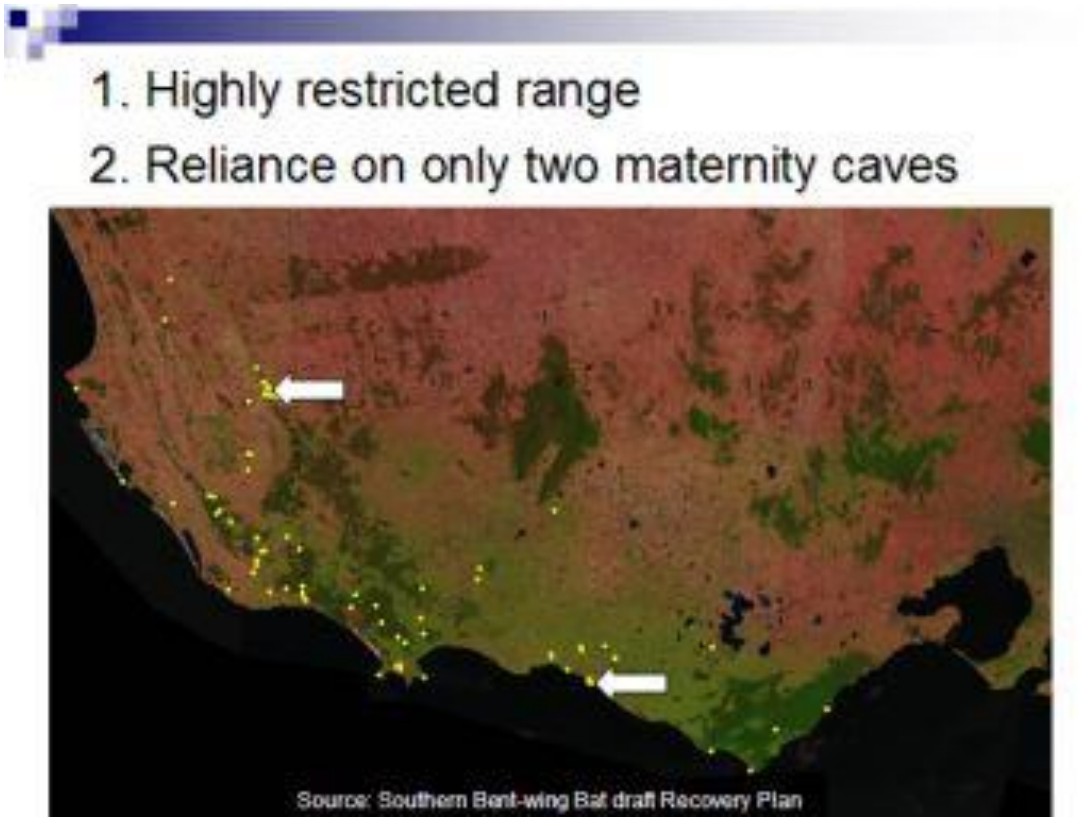
- GPS technology can be applied to tracking bats when a small enough unit can be developed to attach to a bat.
- At this stage there is no information on the impacts of gas fired plants on bats but the risk appears to be low.
- The 2010/11 locust plague and control measures did not extend into Southern Bent-wing Bat habitat.

Southern Bent-wing Bat research at Naracoorte *Caves* -

Kristen Lear, US Fulbright Postgraduate Scholar with the Department of Environment and Natural Resources S.A., in partnership with the University of Melbourne.

Kristen has spent the last year undertaking population monitoring and refining the methodology for counting at Bat Cave.

- The Southern Bent-wing Bat is Critically Endangered
- It has a highly restricted range in south-west Victoria and south-eastern South Australia.
- It is reliant on only two maternity caves (Naracoorte and Warrnambool) which are used for giving birth, raising young and breeding. The maternity caves are used from late August to March. During the non-breeding season from April to August most of the population disperses to use over 50 caves throughout region.
- The population at the Bat Cave alone has suffered a 67% reduction over three generations (100,000-200,000 individuals in 1960s to about 30,000 in 2009).



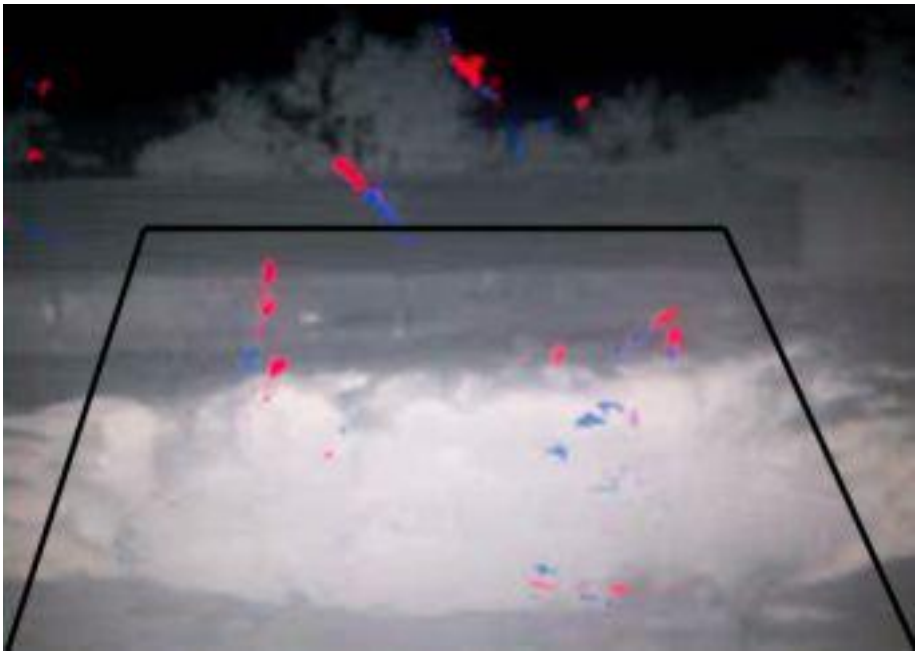
Distribution of Southern Bent-wing Bat - (Miniopterus schreibersii bassanii)

Kristen spoke about population monitoring over the last five decades and various means of estimating the population from counting to video recordings to the use of thermal imaging cameras. She spoke about how the population has fluctuated but overall there has been a dramatic decline since the 1950's.

Current research and findings

Efforts are focused on refining ways to accurately determine population numbers and trends at Bat Cave throughout the year. In addition there is a need to conduct a winter survey of all known over-wintering sites.

Thermal imaging cameras are used to count bats as they emerge from at the Naracoorte Bat Cave. Kristen has undertaken 95 monitoring sessions since September 2011. The counts are analysed by an automated tracking system (Thermal Target Tracker (T3) which can produce an Excel file showing the number of bats emerging and the number going into the cave.

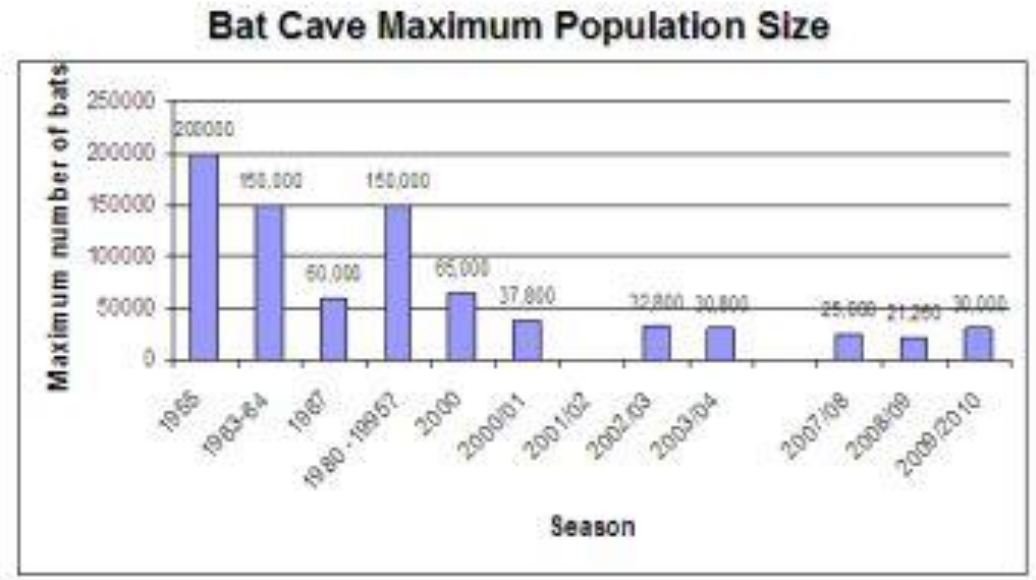


Snapshot of thermal image showing bats leaving the cave shown as red dots.

Results indicate the numbers of bats increases in spring as bats return from the overwintering caves and decreases in autumn as they disperse to overwintering caves.

A peak number of 40,000 bats was recorded mid February 2011. Even though the overall numbers of bats remained fairly constant over the summer considerable fluctuations of up to 10,000 bats were recorded even a few days apart as bats move in and out of the cave to surrounding caves. The peak count of 40,000 bats was about 10,000 higher than counts in recent years but Kristen cautioned against assuming there had been a sustained population growth because of the uncertainty of previous counts (timing and frequency).

Population Monitoring



Winter surveys

Winter surveys are conducted as an additional means of determining the population and to understand the dispersal of bats when they leave the maternity cave. The first winter survey of all known caves was carried out in 1999 but only covered South Australia. In June 2010 the winter survey included both South Australia and Victoria. Results indicate there is high variability in cave use and the surveys have never found more than half the summer population which requires more research.

It is apparent that to fully understand the population thermal tracking equipment must be used regularly throughout the year, over multiple years at Bat Cave. Also annual overwintering counts need to be carried out across the species range.

Key points from questions

- A laser beam monitoring system can be used to measure bat activity. While it doesn't count the individual bats it provides a measure of activity throughout the year which can be used to target the best times to use the thermal imaging counts.
- Thermal imaging cameras cost several thousand dollars and the T3 Tracking software is available free. An alternative system can be used with a Camcorder set on night settings, NTSC format, 320 x 240 pixels, 30 frames per second in order to be compatible with the software. This only works if there are no shadows being cast by the bats.
- Biosis Research hires out the thermal imaging cameras on a daily basis which is an alternative, contact Mark Venosta 0428539534.
- Observations indicate that even over winter there can be some movement between caves.

Contact: Kristen Lear: 0427133315

Southern Bent-wing Bat and windfarms – *overview of impacts, threat assessment and monitoring - Mark Venosta, Sen. Consultant Zoologist, Biosis Research, Port Melbourne, Victoria.*

Mark has been involved with pre-approval wind farm assessment over the last 10 years. The focus on Southern Bent-wing Bats has increased since it was listed as Critically Endangered.

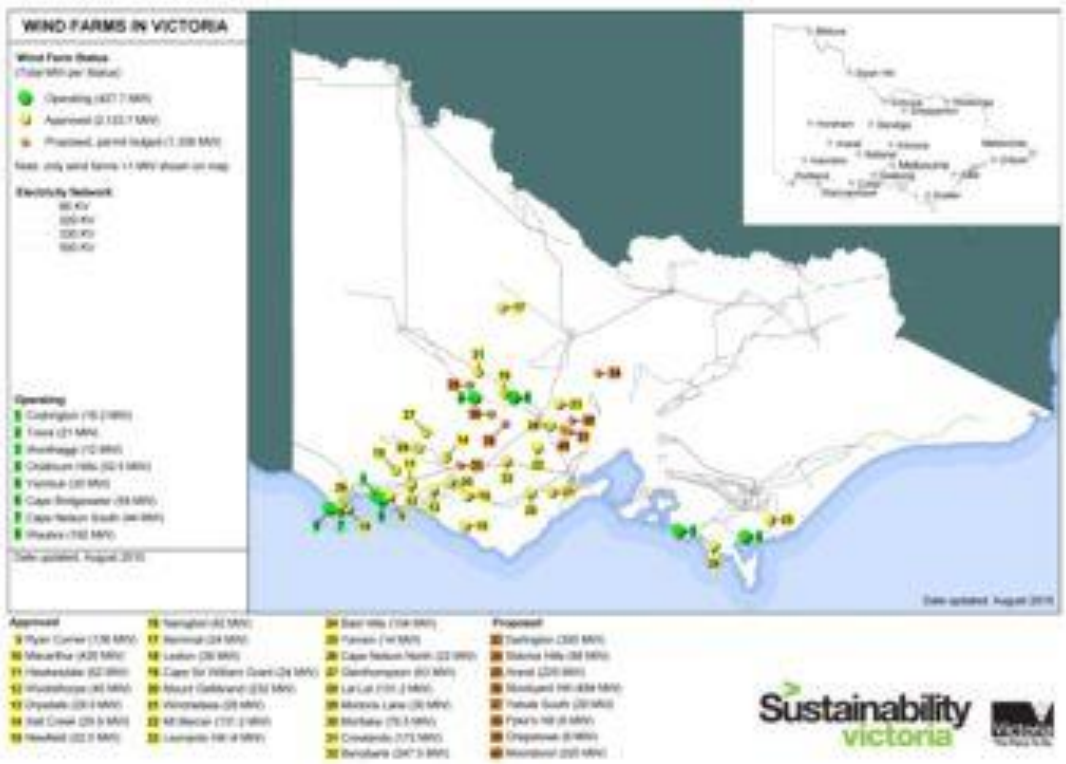


Image from Sustainability Victoria report 2010, showing windfarms. Green dots operating windfarms, yellow dots approved, red dots proposed windfarms.

Mark spoke about the increased emphasis on sustainable energy which has resulted in greater numbers of wind farms both overseas and in Australia where the focus has been on Victoria and South Australia. In Victoria, most of the windfarm planning has been in the south-west which also overlaps part of the Southern Bent-wing Bat distribution.

Impact assessment

Wind farms, particularly overseas were built well before their effect on bats was considered or known. It was only in the 1990s that bats were really considered after bat carcasses were discovered beneath turbines in United States. Bat fatalities recorded in North American and European wind farms are from 'migratory' species during migration periods.

Risks to bats

- Mark spoke about a paper by (Cryan & Barclay 2009) which identified causes of mortalities.
- Proximate causes involve colliding with turbine towers or moving blades or barotrauma (internal injuries as a result of rapid pressure changes near the trailing edges and tips of moving blades).
- Ultimate causes fall into 3 categories:
    - random collisions (usually related to indices of activity or abundance),
    - coincidental collisions (due to prey distribution, migration behaviour e.g. clumping, flying higher, not echo locating), and
    - collisions resulting from attraction of bats to turbines (attraction to lights, sounds, blade motion, insect aggregations, turbines as roosts, mating/gathering sites).

Little is understood about impacts from windfarms on Australian bats and in particular the Southern Bent-wing Bat. We know the Southern Bent-wing Bat is a migratory species but only basic information is available about its behaviour. Mark felt Australia is well behind other parts of the world in the understanding of bat and windfarm interactions. He said more is known regarding the assessment of impacts on birds due to flight behaviour data but a similar understanding is not available for bats.

A problem is that numerous wind farms have already been constructed and many more proposed or approved within the Southern Bent-wing Bat's range. For new proposals the current risk assessments tend to be inconsistent and unlikely to sufficiently quantify the risk to bats. There is a need to improve consideration of bats in relation to windfarm assessment approvals.

Current assessments

Mark explained that Biosis has been undertaking regular monitoring of Byaduk Caves as part of its assessment for a nearby proposed Wind Farm. Biosis has been trialling ways of detecting and identifying bat species using full spectrum analysis together with different modelling tools. They will be looking at ways to determine whether there is a correlation between ground level activity and activity at height. Biosis has also trialled thermal imagery, infrared technology and are currently looking to test radar to gather better information on behavioural aspects.

Post-construction monitoring

Mark has not heard of any reported records of Southern Bent-wing Bat fatalities from windfarms in Victoria, however monitoring of existing windfarms has been opportunistic, sporadic and inconsistent because there are limited requirements on operators to search for mortalities and report findings.

Mark felt we need more information about Southern Bent-wing Bat interactions at current wind farms and a central repository for records, considering there are likely to be more windfarms constructed within the bats range. Other measures which need attention are: completion of the Draft Recovery Plan and a Southern Bent-wing Bat Wind Energy Project in the south-west, similar to the Brolga – wind energy project.

Key points from questions:

- The impact of ultra sonic noise from turbines on bats has not been considered in Australia or overseas and is worth looking into.
- Spiral wind turbines (vertical axis turbines) may have less impact on bats but are not suitable for large scale power generation.
- There are mortality records in Victoria for other species such as the White-striped Freetail Bat which tend to fly higher than other species.
- Recent research indicates blade strike rather than barotraumas is the issue.

- Radar technology holds great promise for detecting the behavioural characteristics of bat at windfarms. See research paper from Rob Gration *Can radar technology overcome the current limitations of surveying for the Southern Bent-wing Bat Miniopterus schreibersii bassanii at wind farms?* *http://publications.rzsnsw.org.au/doi/abs/10.7882/FS.2011.021?code=rzsw-site*
- DeTect Bird and Bat Radar Systems http://www.detect-inc.com/wind.html
- The Portland wind energy project was established prior to the listing of the SBWB and therefore had no requirement in relation to bats.
- A research paper written on bat mortalities from a Tasmanian windfarm will be released soon in a special issue of the New Zealand Journal of Zoology on: Wind Energy and Wildlife.

General discussion summary

- Park management activities involving weed and feral pest programs are not likely to be problematic as far as bats are concerned but emphasis on retaining tree hollows and dead trees is important. Visitor management to reduce access to caves is also important.
- There has been EPBC listing of Seasonal Herbaceous Wetlands (Freshwater) of the Temperate Lowland Plains an http://www.environment.gov.au/cgi-bin/sprat/public/publicshowcommunity.pl?id=97
- Disturbance to bats in overwintering caves needs to be avoided. There are cases where bats have fallen to their death because they try to fly in a state of torpor. Long term impacts are not readily seen. Each time a bat comes out of torpor they use up valuable fat reserves. If there are multiple disturbances there is a high probability they will not have enough energy to feed in the spring and starve to death.
- It has been observed that burnt areas have a reduced bat population, particularly when dead trees used for roosting are removed from the ecosystem.
- There have been observations of bats moving forward of a fire front – it would be very helpful if people involved with fuel reduction burning could report any observations of bat activity to Lindy.
- White-nose syndrome is a fungal disease which occurs in Europe without harm to bats but has spread to North America and wiped out millions of bats. It could have been spread by cavers carrying infected soil on their gear which has raised the need for hygiene of gear. At this stage the fungal disease is not in Australia.