

## *Miniopterus orianae oceanensis* Eastern Bent-wing Bat

### Taxonomy

#### *Miniopterus orianae oceanensis*

The Eastern Bent-wing Bat is currently recognised as a subspecies of the Common Bent-wing Bat *Miniopterus orianae*. This species was formerly called *M. schreibersii*, however genetic studies reveal that the Australian bats are distinct from the overseas *M. schreibersii* (Appleton et al. 2004). Recent authors have recognised the name *orianae* (Woinarski et al. 2014, Jackson and Groves 2015). The long-fingered bats (*Miniopterus* spp.) have recently been elevated to family status (Miniopteridae), splitting them from the Vespertilionidae (Miller-Butterworth et al. 2007). There are three subspecies of the Common Bent-wing Bat, which are morphologically similar, but differ genetically and form separate maternity colonies (Cardinal and Christidis 2000). In Victoria the Eastern Bent-wing Bat overlaps in distribution with the Southern Bent-wing Bat *Miniopterus orianae bassanii*.

### Current conservation status

Listed as threatened under the *Flora and Fauna Guarantee Act 1988* as *Miniopterus schreibersii* (SAC (1992)).  
Categorised as Vulnerable in the 2013 Advisory list of threatened vertebrate fauna in Victoria (DSE 2013).

### Proposed conservation status

Critically Endangered in Victoria

Criteria A3bce; B2ab(iii,v)

### Species Information

#### Description and Life History

The Eastern Bent-wing Bat is a medium-sized, insectivorous bat which roosts in caves, and other underground structures such as disused mines and tunnels.

Mating occurs in May and June, and females become pregnant immediately, however development of the embryo is suspended through winter, recommencing development in spring, resulting in a gestation period of 6-7 months (Dwyer 1963). By November/December all adult females congregate at the only Victorian maternity cave, where females give birth to a single young. Young are left within the maternity chamber of the cave while the adults forage at night. Clustering in large numbers increases the heat and humidity which promotes rapid growth, and the young commence flying in January. By March both the adult females and young have typically left the maternity cave and returned to non-breeding roosts that are spread throughout much of central and eastern Victoria. Adult males typically remain in the non-breeding roosts throughout the year (Menkhorst and Lumsden 1995).

Diet consists predominantly of Lepidoptera (moths). Smaller quantities of a range of other nocturnal flying insects orders are also taken, e.g. Coleoptera (beetles), Hemiptera (bugs), Hymenoptera (ants), Orthoptera (crickets) (Vestjens and Hall 1997).

#### Generation Length

The generation length of the Eastern Bent-wing Bat is estimated to be 10 to 12 years. This is based on breeding not occurring until the bats are 2 years old, and some individuals living to 20-22 years (consistent with the Southern Bent-wing Bat).



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## Distribution

The Victorian distribution of the Eastern Bent-wing Bat is from the Otway Ranges, where it co-occurs in some caves with the Southern Bent-wing Bat, the Castlemaine area where it roosts in disused mines, to across much of eastern Victoria in areas containing either mines or caves. Breeding occurs in just one cave, which is located near Lakes Entrance in Gippsland. Heavily pregnant females banded at Eildon and Christmas Hills have been recorded breeding in this cave, indicating that at least some if not all females from these areas travel the 200-300 km to this maternity cave (Menkhorst and Lumsden 1995). As no other maternity caves have been found in Victoria, it is assumed that this is the only one.

## Habitat

There are two key habitat requirements of the Eastern Bent-wing Bat: roost sites and foraging areas. All known roost sites are underground, predominantly in caves, coastal cliff rock crevices, disused mines (typically horizontal adits rather than vertical shafts) and man-made tunnels. Different caves are used seasonally, as the bats seek the appropriate microclimatic conditions. During the breeding season all adult females congregate at the single maternity site in Gippsland, while outside this period individuals are spread across a large number of roost sites. Foraging occurs primarily over forested areas, but can also occur in more open areas and along beaches (Menkhorst and Lumsden 1995).

## Threats

There are a range of threats to the Eastern Bent-wing Bat. Human disturbance at roost sites can result in the abandonment of a cave, or reduced survival rates of both adults and juveniles. The protection of the single maternity site is critical, as any disturbance during the breeding season could result in the loss of young, due to individuals dropping to the ground. Bats enter periods of torpor over the cooler months and are also vulnerable to disturbance, due to the need to use valuable fat reserves to warm up so that they can fly. Depletion of these fat reserves before spring when more insects become available can result in mortality (Menkhorst and Lumsden 1995).

Roosting habitat is currently being lost due to the collapse of disused mines which are now typically over 100-150 years old, and this is likely to increase in the future as they continue to age. In addition, some mines used as roosts by Eastern Bent-wing Bats have been intentionally closed due to human safety risks (L. Lumsden unpublished data).

Loss of habitat, including clearing of forest environments and draining of wetlands can reduce the availability of foraging habitat. This may be exacerbated during droughts and periods of low rainfall, which reduce prey availability. Low rainfall can also reduce the movement of water through caves, lowering the humidity, making them less suitable as roosting sites. In the future, climate change is likely to result in more extremes and variability in climatic conditions, including a reduction in rainfall and greater likelihoods of droughts. This has the potential to increasingly impact on the survival and breeding success of the Eastern Bent-wing Bat.

Little is known of the impact of fire on bats, although severe bushfire has been shown to reduce the relative abundance of Eastern Bent-wing Bats (Jemison et al. 2012). Fire could impact roosting bats if smoke was drawn into caves. Fire could also impact foraging habitat and prey availability for bats, with large, high intensity fires within foraging range of significant roosting sites potentially reducing food availability for Eastern Bent-wing Bats.

The use of agricultural pesticides may severely reduce the abundance of prey species, such as moths and their larvae, however the full extent of the impact of pesticides is unknown. Ingestion of insects treated with insecticides may cause secondary poisoning. Studies on the closely related Southern Bent-wing Bat have revealed evidence of pesticide residues, including DDT, DDD and DDE, within bat guano and bats (Allinson et al. 2006; Mispagel et al. 2004). DDT has been implicated in significant mortality rates in bats in the USA (Geluso et al. 1976).

A significant future threat is the introduction of White-nose Syndrome (WNS) to Australia. WNS is caused by the fungus *Pseudogymnoascus destructans* which is currently decimating populations of hibernating, cave-roosting bats in North America (Lorch et al. 2016). Millions of bat deaths have been attributed to the fungus since 2006, with mortality rates approaching 100% in some caves. This disease is rapidly spreading across the USA and has now also been recorded in Canada and Europe. It has not yet been recorded in Australia (Holz et al. 2018). However, were it to be inadvertently introduced, it could have equally devastating consequences for Australian cave-dwelling bat species. The fungus grows optimally at temperatures of between 5 and 10 degrees C, with an upper growth

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limit of approximately 20 degrees C (Blehert et al. 2008). Many of the over-wintering caves used by the Eastern Bent-wing Bat are within the temperature range suitable for the fungus. A risk assessment concluded that the introduction of WNS was 'very likely/almost certain' over the next 10 years and that Eastern Bent-wing Bat would be one of the species likely to be impacted (Holz et al. 2016). The extensive movements of bats between roosting sites would result in the rapid spreading of the fungus were it to be introduced.

Feral Cats (*Felis catus*) and Red Foxes (*Vulpes vulpes*) have been recorded preying on bats as they exit caves, sometimes taking significant numbers. For example, Dwyer (1966) reported the accumulated remains of 476 Eastern Bent-wing Bats taken by a fox at a cave in NSW over a two year period, and feral cats have been recorded preying on bats as they exited the Victorian maternity cave (Tony Mitchell unpublished data).

### IUCN Criteria

Criterion A. Population size reduction. Population reduction (measured over the longer of 10 years or 3 generations) based on any of A1 to A4			
	Critically Endangered	Endangered	Vulnerable
A1	≥ 90%	≥ 70%	≥ 50%
A2, A3, A4	≥ 80%	≥ 50%	≥ 30%
<p>A1 Population reduction observed, estimated, inferred or suspected in the past and the causes of the reduction are clearly reversible AND understood AND ceased.</p> <p>A2 Population reduction observed, estimated, inferred or suspected in the past where the causes of the reduction may not have ceased OR may not be understood OR may not be reversible.</p> <p>A3 Population reduction, projected or suspected to be met in the future (up to a maximum of 100 years) [(a) cannot be used for A3]</p> <p>A4 An observed, estimated, inferred, projected or suspected population reduction where the time period must include both the past and the future (up to a max. of 100 years in future), and where the causes of reduction may not have ceased OR may not be understood OR may not be reversible.</p> <p style="text-align: center;">} based on any of the following:</p> <p>(a) direct observation [except A3]</p> <p>(b) an index of abundance appropriate to the taxon</p> <p>(c) a decline in area of occupancy, extent of occurrence and/or quality of habitat</p> <p>(d) actual or potential levels of exploitation</p> <p>(e) the effects of introduced taxa, hybridization, pathogens, pollutants, competitors or parasites</p>			

### Evidence:

#### Eligible under Criterion A2 as Endangered

The population reduction over the past 30 to 36 years is inferred to be 40 to 60% (midpoint 80), based on (b), (c) and (e) above.

The only historical data available are from Dwyer & Hamilton-Smith (1965) which suggests 60,000 individuals were present in the maternity cave in 1963/64. Therefore, there appears to have been a decline in numbers since this time, though the timing of this decline is unknown. If it is assumed that the numbers in the 1980s (i.e. 3 generations prior to now) were similar to those in the 1960s, then there has been a substantial decline. However there is a high level of uncertainty in these figures, so a wide range in numbers has been provided.

#### Eligible under Criterion A3 as Critically Endangered

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The population reduction over the next 30 to 36 years is projected to be 50 to 90% (midpoint 80), based on (b) and (c) and (e) above.

This is based on the suspected decline over the past 36 years and a projected similar decline into the future. Under climate change there could be more droughts, which are known to impact the closely related Southern Bent-wing Bats and so may also impact Eastern Bent-wing Bats. In addition, if WNS was to be introduced into Australia, this taxon could be badly impacted, so the lower limit has been set much lower.

### Eligible under Criterion A4 as Endangered

The population reduction over any 30 to 36 year period, including both past and future, is estimated to be 50 to 70%, based on (b), (c) and (e) above.

Criterion B. Geographic range in the form of either B1 (extent of occurrence) and/or B2 (area of occupancy)			
	Critically Endangered Very restricted	Endangered Restricted	Vulnerable Limited
B1. Extent of occurrence (EOO)	< 100 km <sup>2</sup>	< 5,000 km <sup>2</sup>	< 20,000 km <sup>2</sup>
B2. Area of occupancy (AOO)	< 10 km <sup>2</sup>	< 500 km <sup>2</sup>	< 2,000 km <sup>2</sup>
AND at least 2 of the following 3 conditions:			
(a) Severely fragmented OR Number of locations	= 1	≤ 5	≤ 10
(b) Continuing decline observed, estimated, inferred or projected in any of: (i) extent of occurrence; (ii) area of occupancy; (iii) area, extent and/or quality of habitat; (iv) number of locations or subpopulations; (v) number of mature individuals			
(c) Extreme fluctuations in any of: (i) extent of occurrence; (ii) area of occupancy; (iii) number of locations or subpopulations; (iv) number of mature individuals			

### Evidence:

#### Eligible under Criterion B2 as Critically Endangered

The Area of Occupancy (AoO) across the taxon's range is estimated to be 4 km<sup>2</sup>, based on 2 x 2 km grids derived from accepted, post-1970 records in the Victorian Biodiversity Atlas. Although there are a large number of non-breeding roosting sites and the taxon is distributed over a large extent of occurrence, the area of occupancy is defined as a single site based on there being only one maternity roost within Victoria at which all females give birth to their young.

As all adult females breed in the one maternity cave, and then migrate to non-breeding caves, where the males are, the entire range could be considered just one location, as individuals could be impacted by events at the maternity cave, or if White nosed Syndrome was to be introduced, all individuals could be impacted due to the high level of movement and mixing.

It has a continuing decline in (iii) and (v) above.

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Criterion C. Small Population size and decline		Critically Endangered	Endangered	Vulnerable
Number of mature individuals		< 250	< 2,500	< 10,000
AND at least one of C1 or C2				
C1	An observed, estimated or projected continuing decline of at least (up to a max. of 100 years in future):	25% in 3 years or 1 generation (whichever is longer)	20% in 5 years or 2 generations (whichever is longer)	10% in 10 years or 3 generations (whichever is longer)
C2	An observed, estimated, projected or inferred continuing decline AND least 1 of the following 3 conditions:			
(a)	(i) Number of mature individuals in each subpopulation	≤ 50	≤ 250	≤ 1,000
	(ii) % of mature individuals in one subpopulation =	90 – 100%	95 – 100%	100%
(b)	Extreme fluctuations in the number of mature individuals			

### Evidence:

#### Ineligible under Criterion C

It is estimated that there are 30,000 to 70,000 (midpoint 48,000) mature individuals, which exceeds the thresholds for criterion C.

Criterion D. Very small or restricted populations		Critically Endangered	Endangered	Vulnerable
Number of mature individuals (observed or estimated)		< 50	< 250	< 1,000
D2. Only applies to the VU category Restricted area of occupancy or number of locations with a plausible future threat that could drive the species to critically endangered or Extinct in a very short time.		-	-	D2. Typically: AoO < 20 km <sup>2</sup> or number of locations ≤ 5

### Evidence:


#### Eligible under Criterion D2 as Vulnerable

The taxon has five or fewer locations, and there are plausible future threats that could drive it to become critically endangered or extinct within a very short time.

Criterion E (Quantitative Analysis) was not addressed as the taxon does not have a detailed Population Viability Analysis.

### References

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