Statement on the Bald Hills Wind Farm Application
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Qualifications

BSc (Hons) Deakin University, PhD The University of Melbourne.
PhD Thesis title: Systematics, phylogeography and population genetics of the large bent-wing bat, *Miniopterus schreibersii* (Chiroptera).

Experience

Trapping and researching bats for 8 years.
Previous experience as witness in panel hearing, with regard to wind turbines in south west of Victoria.

Publications

Appleton BR, Norman J, McKenzie JA, and Christidis L () The distribution and population structure of south-eastern Australian *Miniopterus*. Philopatry, or lack of options? (in preparation)

Appleton BR (2004) Genetics in Ecology, In (eds Attiwill P and Wilson B) Ecology, an Australian Perspective. Oxford University Press. Online publication (in press)

Appleton BR, McKenzie JA and Christidis L (2004) Phylogeography of the large bent-wing bat, *Miniopterus schreibersii*. Molecular Phylogenetics and Evolution (in press)

Archer MS and **Cardinal BR** (2001). Seasonal reproduction and host infestation rates for nycteribiids of the large bent-wing bat. Medical and Veterinary Entomology 15, 452-454.

Cardinal BR and Christidis L (2000) Mitochondrial DNA and morphology reveal three geographically distinct lineages of *M.schreibersii* in Australia. Australian Journal of Zoology 48, 1-19.

Bat species likely to be found in the proposed area

Gould's wattled bat,	*Chalinolobus gouldii*
Chocolate wattled bat,	*Chalinolobus morio*
Large bent-wing bat,	*Miniopterus schreibersii*
Lesser long-eared bat,	*Nyctophilus geoffroyi*
Large forest bat,	*Vespadelus darlingtoni*
Southern forest bat,	*Vespadelus regulus*
Little forest bat,	*Vespadelus vulturnus*
White-striped freetail bat,	*Tadarida australis*

Other bat species possible in the area

Eastern Falsistrelle,	*Falsistrellus tasmaniensis*
Large footed Myotis,	*Myotis adversus*
Eastern broad-nosed bat,	*Scotorepens orion*
Gould's long-eared bat,	*Nyctophilus gouldi*
Eastern Freetail bat,	*Mormopterus* sp.

Most of these species are forest dwelling bats. These species roost in tree hollows and under loose bark and therefore may be found wherever such opportunities exist. Forest dwelling bats can travel up to 12 kilometres from their roost in search of food and are known to cover open areas of land as well as vegetated areas. One of the forest dwelling species (White striped freetail bat) and the cave dwelling Large bent-wing bat are known to fly quite high and are known to forage in open areas such as that described at the proposed site. Therefore, these species are possibly at a greater risk from the wind turbines than the other species mentioned.

I will focus my attention on one species. This is because it is within my area of expertise and although there is still much to be learned, this species has been the most extensively studied. It also happens to be listed under the Victorian *Flora and Fauna Guarantee Act* 1988.

The Large Bentwing Bat

General Description

Miniopterus species belong to the suborder Microchiroptera and the family Vespertilionidae. The subspecies relevant to this discussion is named *M. s. oceanensis.* Their long narrow wings enable them to fly swiftly and reduce their capacity for maneuverable flight compared with other species. Individuals use caves as roosts but will also use clefts, culverts and mines. They are nocturnal, insectivorous and forage high above the canopy catching insects on the wing. They can fly at a speed of 50kph.

Roost Requirements

The Large bent-wing bat relies on specific cave microclimates for different seasons. In cooler climates, during winter, Large bent-wings undergo periods of torpor (a mild form of hibernation). The bats will wake to feed or drink each week or so and do move roosts during winter. As such they may be found within the area of the wind turbine even during winter. The bats select cool caves or cool areas within caves as hibernaculae

(Dwyer 1964). The low temperatures allow the individuals to lower their body temperature, reduce their metabolism and conserve energy over the colder months.

Wintering sites can be naturally formed caves of any origin (volcanic or limestone) or anthropogenic sites, including mines and water tunnels. While one specific wintering cave is known to exist at Arch Rock it should be emphasised that the coast features many such caves, all of which are probable or potential wintering sites.

It is thought that it is at wintering sites that the bats mate in Autumn (Dwyer 1963a). These bats store the resulting embryo in suspended animation until after winter. In summer, special caves called ‘maternity caves’, are required for the birth of young. In southern Australia females gather at maternity caves in late spring (November) to prepare for parturition. The specific requirements of the maternity cave limits the number of caves that are suitable. In the area under discussion, the closest maternity cave is located at Nowa Nowa, near Lakes Entrance.

Reproduction

In November, females move from their winter roosts and congregate at maternity sites. The winter roosts associated with the Nowa Nowa maternity site reach as far as the western district of Victoria (Lorne, Stoneyford), Castlemaine, Eildon and into New South Wales. Research shows that they appear to move *en masse* with the bulk of bats arriving in one or two days. The single young are born between early December and mid-January. Numbers at the maternity colony rapidly decline during late summer, with adult females leaving once reproductive responsibilities have ceased. The juveniles leave in a second wave, after the adults. The bats move out from the maternity cave to wintering sites, where they will remain actively foraging during Autumn.

Movement and Philopatry

It has been demonstrated in many bat species that high roost fidelity is directly related to roost permanency and inversely related to roost availability (Brigham 1991; Kunz 1982; Lewis 1995). If roosts differ in quality or are widely spaced, fidelity to familiar roosts would avoid expending energy in searching for new suitable roosts and feeding grounds. If such benefits are to be found in fidelity to roosts, any bats that voluntarily move are expected to do so only if the benefits balance or outweigh the costs (Lewis 1995). Bats may move in response to disturbance or as a response to, or an avoidance of, predators or parasites. Variation in the required roost microclimate during the year may also be enough to prompt movement to a more suitable site. A change in roost fidelity according to the season may also be beneficial in familiarising the young of a particular year with a variety of roosts and feeding areas.

An extensive banding and recapture program of Large bent-wings, undertaken during the 1960s, found that individuals were capable of nightly foraging flights of over 40 kilometres (Dwyer 1969). Site attachment is well developed, especially in males. This means each male bat will often be found at one or a small group of caves near the original capture site. Site attachment was also found to increase with age. Females, however, were often recaptured at a different site to the original banding location. It was postulated that the usual (annual) long distance movements of females related to movement towards, or away, from their maternity site (occasionally over 300 kilometres) (Dwyer 1966). Movements of 200 km have been recorded in a single night. Juvenile movements are thought to be dispersive and I have collected juvenile bats that have travelled from their natal maternity site at Nowa Nowa, near Lakes Entrance, to Lorne.

Banding studies have shown that there is extensive movement between wintering and maternity sites. Bats winter in the many caves along the southern coast. They may use these sites as a route of travel between sites or simply move from wintering site to wintering site. Other bats, especially males, may be residents of particular caves and use the area as a foraging ground.

Conservation Significance

M. schreibersii is classified as a threatened species within Victoria under the *Flora and Fauna Guarantee Act* 1988 with a nomination, due to its restricted colonial breeding, accepted in 1992. To date, however, only a draft action plan exists for the species. The IUCN classifies *M. schreibersii* as near threatened globally and Stebbings (1988) regarded *M. schreibersii* as endangered in western Europe and possibly throughout the world. Colonies that contained thousands of individuals have been markedly reduced in numbers or have disappeared. This species is very sensitive to any form of disturbance in its roosts and is reported to be suffering a reduction in numbers in southern Australia.

Environmental Effects Statement (EES)

The EES for the Bald Hills Wind Farm noted that the area was suboptimal foraging, in that it was cleared farmland. This is not the case for the Large bent-wing bat or the White striped freetail bat. Both species are known to forage in cleared areas. The site is also very close to the wetlands, which are optimal feeding grounds for all bats. Both tree hole roosting and cave dwelling species may fly through the proposed windfarm area in order to reach the wetland foraging areas. Substantial activity by White striped freetails was recorded at the Bald Hills site and this species has been found dead under turbines at Codrington.

The EES stated that the Large bent-wing bats would use the Arch Rock site during winter and therefore the activity of these bats would be minimal. This is misleading as ‘wintering’ sites are used year round by bats. Adult males and young bats are found at wintering sites regardless of the season while adult females leave the wintering roosts only in summer. Individuals may move between wintering sites at any time of the year. These bats will wake from torpor to feed or drink and although their activity is reduced in winter, it is still likely that they will forage occasionally. The Arch Rock roost has been visited recently (contrary to statements in the EES) and adult males and pregnant females have been recorded in October. This is a time of high bat activity (spring) as individuals attempt to put weight on after the winter months and females are also supporting developing offspring. Visiting the site would allow the EES study group to ascertain the number of bats using Arch Rock.

The EES states that bentwings were not recorded as occurring during the study period. Since the study consisted only of Anabat survey with only two units, on limited nights, some of which appeared unsuitable for bat activity, I am not surprised by this statement. I am concerned by the lack of data. Due to changes in seasonal use of areas and potential fluctuations in assessment, many researchers now believe that Environmental Effects surveys for wind turbines should involve a two year study of the area (Williams 2004). Wind is not the only factor to affect bats and I would be interested to know other weather conditions on those nights (eg. temperature and rainfall). The EES also says that there is no way of detecting numbers of bats in the area. Many bat researchers use measures of relative bat activity to overcome this problem.

The EES also states that there are no experiences of wind-farm impacts on bats in Australia, but there are known bat mortalities at windfarm sites in Victoria and Tasmania. If this statement relates to experiences of wind-farm impacts on populations of bats, then this may be true due to the fact that no studies have been undertaken on this issue.

Further bat monitoring was flagged in the EES, where the details of this were not clear.

A collection of broad statements was included based on limited literature. These are addressed below.

The EES mentioned that there were no documented problems with windfarms in relation to bats in Europe. This is incorrect with reports from Germany, Sweden and Spain, (http://www.iberica2000.org/documents/EOLICA, Keeley 1999)

'Most monitored windfarms in America have shown very little bat mortality.' This is clearly incorrect. Many studies reveal actual (minimum) mortality rates of 2-30 bats per turbine per year. When large number of turbines are used, this can be a substantial number of deaths. It must also be remembered that the estimates actually reported may be a vast underestimate of the true numbers killed. Many reports recognise this and some have doubled their estimates due to this fact (Buffalo Mountain, Tennessee wind energy facility). One American site projected a potential of 100,000 bats killed per year, which is the highest bat mortality recorded in the world (Allegheny Front, Eastern North America). Monitoring of existing wind turbines may not give an accurate estimate of the damage caused. These bats are extremely small and therefore, if struck by the turbine blades they could be thrown quite a distance. The remains of the bat may not be substantial and the remains would not last for long on the ground due to decay or being scavenged by foxes or birds, and therefore, we would not accurately gain an understanding of the mortality rate. Other reasons for underestimation include terrain, frequency of checks, thoroughness of checks and accuracy of reporting.

'Up to six species have been killed by windfarms in America'. More species than this have been reported.

The EES states that most bat mortalities are associated with severe weather. Numerous records show that bat mortalities are not associated with severe weather events. One of the major concerns to many researchers is that the reason for bat mortalities is unknown (Williams 2004, Keeley 1999).

'No windfarms have lead to levels of bat mortality that could affect regional populations'. This statement assumes that all bat populations have been studied to an extent which would allow this to be quantified. This is incorrect. It also assumes that the bat mortalities are always low, which is incorrect (see above).

This collection of statements appears to have been taken from one paper from the internet. This paper was written by consultants to the wind power industry in America (advocating wind turbines). It is always important to keep in mind the affiliations of the author of any information.

The estimated levels of bat mortality in the EES are based on the lowest numbers found in any of the publications. The statement that future monitoring will allow these predictions to be tested, implies that wind farms should be constructed and once it is too late we will find out what impact they have.

Recommendation

In my opinion, the proposed windfarm should not be approved until the necessary investigations into effects on bat mortality have been carried out.

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