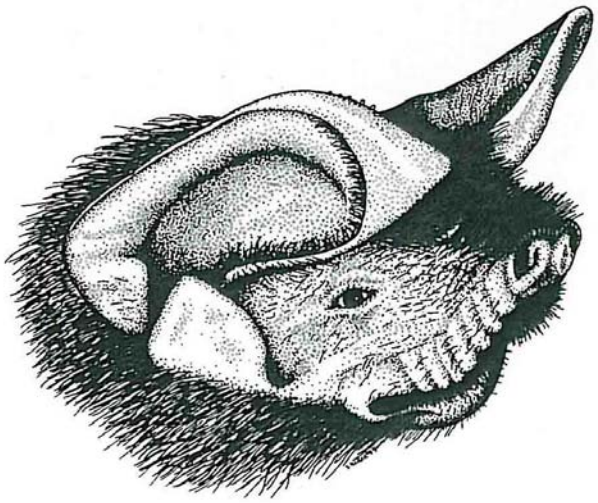
Binningup Bat Survey
2009

Echolocation Survey of Bat Activity in the Lake Clifton and Lake Preston Localities on the Swan Coastal Plain.



Prepared for Department of Environment and Conservation

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Echolocation Survey of Bat Activity in the Lake Clifton and Lake Preston Localities on the Swan Coastal Plain.

Contents.

1.0 Summary

1.1 Background and Methods

Chiroptera species presence or absence, with an estimate of activity level, is presented for an area of the Swan Coastal Plain west of the Old Coast Road between Dawesville and Australind. Bat Call WA carried out the study during the summer and autumn of 2009 based on a systematic echolocation based survey. This survey was supplemented with available bat presence data from a number of sources including the Western Australian Museum collection and the records of Bat Call WA.

1.2 Habitats

Seven habitats were sampled for microbats bats at 12 sites, covering the northern and southern halves of the area. These were considered representative of habitats present in the study area and adjacent Swan Coastal Plain bioregion. Habitats ranged from coastal shrub covered aeolian dunes through various woodland types to mature tuart stands.

1.3 Bat Fauna

A bat fauna of seven insectivorous microbat species was confirmed as present in the study area. Four of the seven species were found across the heath and shrub covered coastal dune systems. Between five and seven species were found in areas with healthy shrubland, woodland and mature tuart stands. One DEC Priority 4 species, *Falsistrellus mckenziei*, was found to be present in the woodland habitats in conjunction with the nearby availability of permanent fresh water.

Two microbat species that are known to be present to the south and east of the study area, the adjacent Jarrah forest and southern Swan Coastal Plain, *Chalinolobus morio* and *Nyctophilus gouldi*, were not detected during the study.

One frugivorous megabat has been recorded in the region but its presence is not considered permanent.

It is recommended that a focussed study be carried out in the adjacent Swan Plain between Pinjarra and Harvey to provide

baseline presence data for *Falsistrellus mckenziei*, a DEC Priority 4 species.

2.0 Introduction

2.1 Background to the Binningup Bat Survey and the Location of the Project Area.

The Department of Environment and Conservation of Western Australia (DEC) have commissioned Bat Call WA to complete an echolocation-based survey of Bat activity in the Lake Preston and Lake Clifton localities of the Swan Coastal Plain. This region lies between Dawesville and the Leschenault Estuary between the coast and Old Coast Road. It includes the communities of Preston Beach, Myalup and Binningup and Yalgorup National Park.

The project area is bounded by Tims Thicket Road in the north (32^{o} 39' south), Old Coast Road in the east, Buffalo Road in the south (33^{o} 12' south) and the coast in the west. This area is subject to increasing pressure from the expansion of the Perth and Bunbury metropolitan areas and associated development in the intervening district.

2.2 Scope and Objectives of the Study

This report documents the results of an echolocation-based survey of the project area and its immediate surrounds. The project area is approximately 60 km north to south by approximately 5 km west to east. The area includes a number of habitat types that offer a variety of foraging and roosting opportunities for the local bat fauna.

The objectives of the study are:

- To provide baseline information based on a systematic survey of bat activity. This survey was designed to cover summer and autumn conditions. It was also designed to cover seven primary habitats represented in, or adjacent to, the project area that may be attractive to bats found across the southern Swan Coastal Plain bioregion.
- Enhance the baseline survey data with echolocation and voucher specimen data available from a number of sources.
- Provide a measure of bat activity in the project area, by season and habitat, that may be used as a guide for bat activity in the adjacent southern Swan Coastal Plain bioregion.

2.3 Purpose of the Report

This report describes surveys of the bat fauna activity in the seven primary habitats within and adjacent to the project area undertaken by Bat Call WA in the summer and autumn of 2009. The results of that survey were supplemented by non-systematically collected data from available echolocation sampling and also by the relevant listings of Western Australian Museum (WAM) collections. It is a supporting document to a broader DEC

fauna and flora survey. The survey undertaken by Bat Call WA was subject to certain limitations that are outlined in Section 3.7 below.

2.4 Existing Environment

The southern part of the Swan Coastal Plain comprises the Perth Coastal Plain. This is part of the South West Botanical Province. The project study region comprises six primary habitats suitable to bats with a seventh abutting the area for a significant length of the eastern border.

Following Mitchell et al. (2002) a description of the southern Perth Coastal Plain follows. The climate is classed as warm Mediterranean and rainfall is approximately 800mm per annum. It includes the coastal settlements of Preston Beach, Myalup and Binningup. It is dominated by wetlands associated with the permanent, brackish Lakes Clifton and Preston and the associated lake system, heaths and tuart woodlands on sandy soils. It also contains areas of *Banksia* woodland on aeolian dunes, *Melaleuca* paperbark in swampy areas, areas cleared of vegetation for agricultural activities and extensive areas of forestry-plantations (pine) bordering to study area to the east.

There are no major natural riparians in the study region although the Harvey River Diversion Drain that apparently contains water on a semi-permanent basis crosses it.

The Swan Coastal Plain has been exposed to almost every type of environmental disturbance. Its stress class value should be between 1 and 2 (McKenzie and May 2003). The established areas of Yalgorup National Park aside, the overall condition of both wetlands and drylands is classed, in McKenzie and May (2003) as degraded.

3.0 Methodology

3.1 Data Base Searches

Data base searches were carried out in February 2009 as follows:

- The WAM FaunaBase database was searched for records of vouchered Chiroptera between 32^{O} 30'S and 33^{O} 10'S and 115 ^{O} 30'E and 115 ^{O} 50'E.
- The Bat Call WA database of existing non-systematically obtained echolocation records of Chiroptera recorded in or adjacent to the study area.
- The library of DEC reports available to the study team was reviewed for listings of Chiroptera.

Results of these searches are contained in Appendices 2, 3 and 4 respectively.

3.2 Survey Timing, Moon Phase and Weather

The systematic echolocation survey was conducted over two seasons. All twelve sites were surveyed in summer between 24th January and the 15th February. All sites were repeated in autumn between 27th March and 11th April.

The Jan-Feb survey was conducted in typical summer weather conditions. All sampling evenings were fine and clear with temperatures between 20 and 25^{O}C at twilight. The moon in this period moved from new to last quarter allowing the majority of evenings to be dark during the first three hours after sunset.

The autumn survey was conducted in an abnormally warm and dry period for the region. All sampling evenings were fine and clear with temperatures between 20 and 25^{O}C at twilight. The moon in this period moved from new to full.

The systematic survey data were supplements by available echolocation based listings from Bat Call WA library. These data had been taken opportunistically and the majority were spring recordings. Weather conditions for these opportunistic data are not given.

3.3 Survey Team

The bat sampling work was conducted by R.D. Bullen and C.L. Bullen. All activities were conducted under "Licence to take fauna for scientific purposes" No. SF006739 issued to R.D. Bullen on 8 Jan 2009.

Analysis of echolocation recordings was completed by R.D. Bullen.

3.4 Systematic Sampling

The summer and autumn systematic survey consisted of completing approximately three hours of bat sound recordings, beginning at twilight, at 12 locations within and immediately adjacent to the survey area. Seven habitats were sampled with five being common to the northern half and the southern half of the study area. One habitat was sampled in the north and one in the south that were not available in the alternate half of the area. Locations were selected within each habitat that were representative of the habitat in its best available condition. The recordings were made using Anabat II (Titley Electronics, Ballina, NSW) detectors, set to divide by 16, in conjunction with Portable Minidisk Recorder model MZ-NH700 (Sony, Japan). Minidisks were run in Hi-MD mode with Hi-SP setting allowing 3 hours of recording on a 1GB Hi-MD disk.

COOL EDIT 2000 (Now available as AUDITION from Adobe Systems Inc.) was used to display each call sequence for identification. Only good quality call sequences were used.

Bat activity was then characterised as "Low", "Medium" or "High" based on the rate of call sequences recorded.

- Low species activity is referred when a species is recorded with call spacing greater than ten minutes,
- Medium species activity refers to call recordings more often than 10 minutes but less often than two minutes apart for a significant time period.
- High species activity refers to call recording more often than two minutes apart for significant periods.

3.5 Non-systematic Sampling

All available sources of bat presence data were reviewed and the results were supplemented to the systematic survey results. Sources reviewed included the Fauna Base listings of the Western Australian Museum, the library of Bat Call WA opportunistic echolocation recordings and other available DEC publications covering the study area. These data are presented in Appendices 2 to 4 below.

3.6 Vegetation Types and Fauna Habitat Classification at each survey site.

Seven primary habitats were identified within the study area that were considered interesting for bat roosting and/or foraging presence. These were based on vegetation structure and landforms and not on particular flora species present. Twelve sites, titled BAT 1 to BAT 12, were selected for survey, refer to Plate 3.1 below. These covered five of the habitats in both the northern and southern half of the study area, one site BAT 6, that included habitat only present in the north and one site, Bat 12 that included habitat only present in the southern half of the study area.

These are:

- Coastal heath and shrublands over aeolian dune system. BAT 1 on Tims Thicket Road (32^{O} 39' 19"S, 115^{O} 37' 00"E) and BAT 7 on Buffalo Beach Road (33^{O} 12' 7"S, 115^{O} 41' 14"E). See Plates 3.2 and 3.8.
- Medium mixed woodland (good condition) over sandy soil with lake proximity. BAT 2 on Martins Tank Lake campground track (32^{O} 50' 19"S, 115^{O} 39' 50"E) and BAT 8 on Lake Preston Road (33^{O} 03' 01"S, 115^{O} 41' 21"E). See Plate 3.3 and 3.9.
- Extensive stand of *Melaleuca* paperbark shrublands over swampy soil. BAT 3 on Estuary Road (centred on 32^{O} 39' 59"S, 115^{O} 39' 13"E) and BAT 9 at O'Reilly's Reserve on Buffalo Road (33^{O} 11' 55"S, 115^{O} 41' 37"E). BAT 3 also has extensive limestone outcrops adjacent. See Plate 3.4 and 3.10. For the autumn survey a transect was performed along Estuary Road covering approximately 6 km north and 3 km south of the reference location.
- Mature Tuart woodland. BAT 4 on Lake Hayward day use area track (32^{O} 53' 32"S, 115^{O} 41' 26"E) and BAT 10 on Treasure Road (33^{O} 10' 31"S, 115^{O} 43' 11"E). See Plate 3.5 and 3.11.
- Sparse mature woodland over improved pastureland. BAT 5 on Preston Beach Road North (32^{O} 50' 58"S, 115^{O} 39' 53"E) and BAT 11 on Myalup Beach Road (33^{O} 06' 31"S, 115^{O} 42' 51"E). BAT 11 is also adjacent to the Harvey River Diversion Drain. See Plate 3.6 and 3.12.
- Coastal shrublands over limestone covered dune system. BAT 6 on White Hill Road. BAT 6a is at 32^{O} 41' 24"S, 115^{O} 37' 03"E. See Plate 3.7. This site was moved 500 m east to BAT 6b for the autumn survey to the edge of a thin woodland stand at 32^{O} 41' 23"S, 115^{O} 37' 24"E.
- Forestry plantation (pine) over sandy soils. BAT 12 at dam on Centre Break Road (33^{O} 04' 31"S, 115^{O} 45' 23"E). See Plate 3.13.

These seven habitat types would be expected to be representative of the majority of the Perth Coastal Plain between Mandurah and Bunbury and inland as far as the Darling Escarpment. Other habitats such as irrigated horticulture, rural residential, tumulus springs and samphire may be present in the region but these are not considered extensive enough to support stable and unique bat assemblages.

3.7 Survey Limitations

Systematic sampling was targeted at the seven most common bat habitat types in, and adjacent to the study area. All sites were easily accessed and the recorders were set at ground level with the microphone pointing directly upward. Bat sound recording was carried out for approximately three hours beginning at twilight. The survey method may be biased against species that are known to forage close to the ground or species that may forage late in the evening on hot nights. Species that may be under-represented as a result may include *Nyctophilus geoffroyi* that is known to occasionally glean from the ground and *Tadarida australis* that is known to forage late into the evening

during hot weather (nights that the minimum overnight temperature remains around 20^{O}C).

Bat species density is impossible to estimate from echolocation records. Bat activity is therefore substituted as an approximate guide to the relative numbers of each species using the study area.

Supplementary data were strictly opportunistic and were not collected using a systematic survey regimen. Echolocation recordings from Bat Call WA's library may be any time duration and may be recorded at any time during the night. These data are presented as "presence" records only.

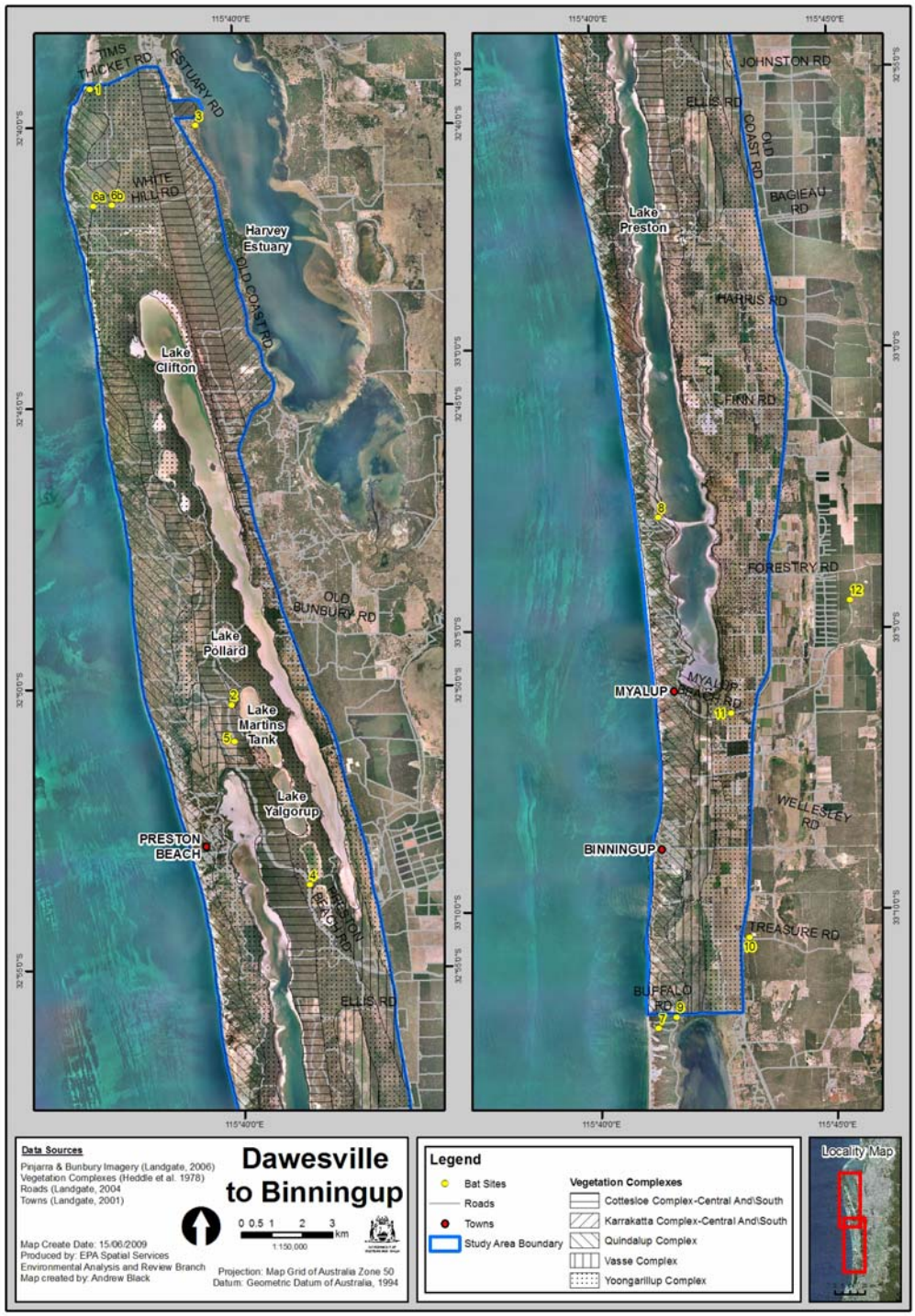

Plate 3.1 Study Area

Plate 3.2 - BAT 1: Low shrubland over Coastal Dune System

Plate 3.3 - BAT 2: Medium Mixed Woodland

Plate 3.4 – BAT 3: Paperbark Shrubland

Plate 3.5 – BAT 4: Mature tuart woodland

Plate 3.6 – BAT 5: Thin woodland over improved pasture (summer).

Plate 3.7 – BAT 6a: Shrubland over limestone covered dune system.

Plate 3.8 – BAT 7: Low Shrubland over Coastal Dune System

Plate 3.9 - BAT 8: Medium Mixed Woodland

Plate 3.10 – BAT 9: Paperbark Shrubland

Plate 3.11 – BAT 10: Mature tuart woodland

Plate 3.12 – BAT 11: Sparse woodland over improved pasture (summer).

Plate 3.13 – BAT 12: Forest Plantation (pine).

4.0 Bat Fauna Survey Data

4.1 Systematic Survey Results

There are nine species of microbat extant on the southern Swan Coastal Plain and the adjacent Jarrah Forest bioregions. Of these, seven were detected during the summer and autumn systematic survey. The results are summarised in Table 1 and presented in Appendix 1 in full.

4.2 Supplementary Species Presence data

Data from WAM FaunaBase (to Feb. 09) are presented in Appendix 2. These data include the adjacent districts between Mandurah and Furnissdale in the north to Bunbury in the south.

Data from the library of Bat Call WA are presented in Appendix 3. These data include the adjacent districts between Mandurah, Nambeelup and Furnissdale in the north to Bunbury in the south.

Data from available reports from the DEC library are presented in Appendix 4.

There were no additional microbat species detected from these sources.

A single specimen of the megabat Pteropus scapulatus was collected south-west of Pinjarra in 1990 and was lodged in the WAM collection. This specimen is considered an itinerant animal that has strayed far to the south of its normal range in the tropical north.

4.3 Microbat species present in the study area.

Chalinolobus gouldii (Gould's wattled bat) is ubiquitous throughout temperate and tropical Western Australia. It is a medium size (13g) insectivore and commonly roost in tree hollows (Churchill 1988). Its conservation status is not listed (EPBC Act 1999). In the study area it presence is confirmed in all habitats except surprisingly, the mature Tuart sites. This "absence" is considered to be an artefact of the survey, as the species is known from forest areas elsewhere in the Swan Coastal Plain and the Jarrah Forest. The activity level of this species is characterised as low to high during this study depending upon the location and weather conditions. It is considered to be extant across the entire study region.

Historically, *Falsistrellus mckenziei* (western false pipistrelle) has been found in the Swan Coastal Plain and the Jarrah forest as far north as the Great Eastern Highway. At 20 g it is the second largest of the insectivorous bats that inhabit the South West forest and adjacent coastal plains. Due to its size, this bat requires a particularly productive habitat to persist in hard times. Its preferred habitat is hardwood forest and the open woodlands that adjoin it (Start and McKenzie 2008). It commonly roosts in tree hollows and branches. In recent years it appears to be withdrawing southward with the progressive

drying of the Darling Range (Bullen, R 2008). Its conservation status is near threatened with a decreasing population trend (IUCN 2008). It is a DEC Priority 4 species. In this study its calls have been recorded in all seasons at low activity levels at a number of sites in the study area as far north as White Hill Road at approximately 32^{O} 41' S. It has been recorded at sites combining woodland with a nearby (within 1.5 km) "permanent" fresh water source.

Mormopterus sp. (form sp 4 in Adams et al. 1988) (south-western free-tailed bat) is a small (~10g) insectivorous molossid that forages around and over the upper canopy. The Mormopterus present in the study area is the southwestern species (Pop'n O of sp. 4 – previously known as *M. planiceps*). This bat is commonly found in the mesic and semi-arid southwest of WA (McKenzie and Bullen 2008). It forages over forests and woodlands and usually roosts in tree hollows. Its conservation status is not listed (EPBC Act 1999). The activity level of this species was low during this study. It was found in all habitats away from the coast and has not been detected over the coastal dune systems irrespective of vegetation cover or season.

Nyctophilus geoffroyi (lesser long-eared bat) is a ubiquitous, small (~6g) insectivorous bat that forages close to and within most types of vegetation and understorey. (Churchill 1988). It is common throughout Western Australia and was found in all habitats of this study. It commonly roosts in tree hollows, under peeling bark, in crevices and in buildings. Its activity level was low during the study period at all sites except the northern mature Tuart site. Its conservation status is not listed (EPBC Act 1999). It is considered to be extant across the entire study region.

Nyctophilus timoriensis major (western greater long-eared bat) is a medium size (~15g) insectivorous bat that forages in cluttered airspaces of the forests and woodlands of southwest WA. (McKenzie 2008). It was found in all habitats of this study except the shrub covered coastal dune systems. It commonly roosts in trees. Its activity level was low during the study period although higher activity levels have been recorded in the Melaleuca stands on Buffalo Road. Its conservation status is not listed (EPBC Act 1999).

Tadarida australis (white-striped free-tailed bat) is a large (~35g) insectivorous molossid. It forages above the canopy and expands and contracts its range from all cooler regions (present year round) to tropical regions of WA during the winter (Bullen and McKenzie 2005). During the study it was recorded only occasionally during the summer but was detected in medium and high numbers in the autumn at a number of sites. This species is known to move in numbers north along the coastal plain during the autumn and south again during the spring. The result of this survey is consistent with that behaviour. It commonly roosts in large (old or dead) eucalypts often occupying the hollow trunks (Rhodes and Richards 2008). Its conservation status is not listed (EPBC Act 1999). It is considered to be extant across the entire study region in low numbers except for the time of the spring and autumn range expansion/contraction.

Vespadelus regulus (southern forest bat) is the smallest (~5g) insectivore found across the shrubland, woodland and forest of southern WA. They forage close to the vegetation of the lower canopy and the understorey (Churchill 1998). They commonly roost in tree hollows but use other locations such as house roofs as well. This species was the most commonly recorded bat found in all habitats showing activity levels from low to high. Its conservation status is not listed (EPBC Act 1999). It is considered to be extant and quite common across the entire study region.

4.4 Microbat species not detected in the study area.

There are two microbat species known from the adjacent Jarrah Forest and southern Swan Coastal Plain bioregions that were not detected during the survey. These are *Chalinolobus morio* (chocolate wattled bat) and *Nyctophilus gouldi* (Gould's long-eared bat). Both are thought to be short-range foragers rarely moving 10 km from their roost location. In addition *C. morio* is a cave dwelling species in southern WA limiting its possible presence to the very small region in the north of the study area where suitable limestone outcrops are available. Both are known from the Jarrah forest and from the Swan Plain south and west of Bunbury. The absence of these species from the area's available records including the WAM records, the earlier publications and the library of Bat Call WA confirm that these species are not present in the study region.

4.5 Megabat species present in the study area.

There were no frugivorous or nectivorous megabats detected during the study. There is a single record in the WAM Fauna Base of a specimen of *Pteropus scapulatus* (little red flying fox) collected from farmland southwest of Pinjarra, close to the study region. This bat is a large (~400g) strong flyer capable of long distance flights. Clearly this record is an individual that had wandered far to the south of its usual range, tropical WA north of Shark Bay. Extraneous visits of this type to the study area cannot be ruled out but would be extremely rare events.

Table 1: Summary of Microbat species present by season and habitat.

		Habitat 1 Coastal heath and shrubland over aeolian dune system			Habitat 2 Medium mixed woodland over sandy soil with Lake proximity		
Genus species Authority	**Common name**	**Spring**	**Summer BAT 1 & 7**	**Autumn BAT 1, 7 & other**	**Spring WAM + Other**	**Summer BAT 2 & 8**	**Autumn BAT 2, 8 & other**
Chalinolobus gouldii (Grey 1841)	Gould's wattled bat		Low	Med	Present	Low	Low
Chalinolobus morio (Grey 1841)	chocolate wattled bat						
Falsistrellus Mckenziei - Kitchener et al. 1986	western false pipistrelle						Low
Mormopterus sp.(form sp. 4 (pop O) in Adams et al.1988)	south-western free-tailed bat				Present	Low	Low
Nyctophilus geoffroyi - Leach 1821	lesser long-eared bat		Low		Present	Low	
Nyctophilus gouldi - Tomes 1858	Gould's long-eared bat						
Nyctophilus timoriensis major - Grey 1844	western greater long-eared bat					Low	
Tadarida australis (Grey 1838)	white-striped free-tailed bat		Low	Med			Med
Vespadelus regulus (Thomas 1906)	southern forest bat		Med	Med	Present	Med	Low

Table 1 continued.

	Habitat 3 Paperbark shrubland over swampy soil			Habitat 4 Mature tuart			Habitat 5 Sparse woodland over improved pasture		
Genus species	**Spring** **Other**	**Summer** **BAT 3 & 9**	**Autumn** **BAT 3 & 9**	**Spring**	**Summer** **BAT 4 & 10**	**Autumn** **BAT 4 & 10**	**Spring** **WAM + Other**	**Summer** **BAT 5 & 11**	**Autumn** **BAT 5, 11 & Other**
Chalinolobus gouldii	Low	Low	Low				Present	Low	Low
Chalinolobus morio									
Falsistrellus Mckenziei	Low				Low		Present		
Mormopterus sp.						Low	Present	Low	Low
Nyctophilus geoffroyi		Low	Low		Low	High	Present	Low	Low
Nyctophilus gouldi									
Nyctophilus timoriensis major	Med	Low	Note 1		Low			Low	
Tadarida australis						Low	Present		Med
Vespadelus regulus	Med	Med	Low		Low	High	Present	Med	Low

Table 1 concluded.

	Habitat 6 Coastal shrubland over limestone covered dune system			Habitat 7 Forest plantation (pine).		
Genus species	**Spring**	**Summer** **BAT 6**	**Autumn** **BAT 6**	**Spring** **Other**	**Summer** **BAT 12**	**Autumn** **BAT 12**
Chalinolobus gouldii			High	Present	Med	High
Chalinolobus morio						
Falsistrellus Mckenziei			Low	Present	Low	
Mormopterus sp.				Present	Low	Low
Nyctophilus geoffroyi			Low		Low	Low
Nyctophilus gouldi						
Nyctophilus timoriensis major					Low	Low
Tadarida australis			High	Present	Low	
Vespadelus regulus		Low	Med	Present	Med	High

Note 1: Nyctophilus sp. was recorded during the survey at Bat 9 but the sequences were low quality and the particular species could not be determined accurately.

5.0 Bat fauna habitat implications for the Swan Coastal Plain

This survey has confirmed that there is a bat fauna of seven insectivorous microbat species extant across the majority of the Swan Coastal Plain between Mandurah and Bunbury. Habitats close to the coast comprising heath and shrublands over aeolian dune systems had species counts up to four while woodland habitats had species counts between five and seven. It is expected that this pattern will be repeated eastward across the plain to the base of the Darling Range wherever a healthy and extensive woodland stand exists, especially in conjunction with a nearby permanent source of fresh water.

One study area species in particular, *Falsistrellus mckenziei*, has a DEC Priority 4 listing indicating a taxa in need of monitoring. It was pleasing to detect this species across the area considering both the apparent recent range contraction south in the adjacent Darling Range and the warm and dry nature of the summer and autumn of 2009. Retention of this species within the region is considered important for the biodiversity of the region. From the results of this study, its continuing presence is considered to be closely linked to the combination of healthy and extensive open woodland stands in conjunction with permanent fresh water sources. Further targeted survey effort is therefore recommended for this species to complete a baseline in this region, on the Swan Plain between Pinjarra and Harvey. Focus should be on the various watercourses associated with the Harvey River and the area east of the Harvey Estuary.

Two insectivorous microbat species that are known to be present to the south and east of the plain were not found in the study and are not considered extant in the region.

There is no permanent frugivorous megabat activity in the region although occasional visits by vagrant megabats may occur.

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Appendix 1. Microbat lists obtained during this survey. Data are presented by site and by season. Activity levels are as described in Section 3.4.

Genus-species	BAT 1 Summer	BAT 1 Autumn	BAT 2 Summer	BAT 2 Autumn	BAT 3 Summer	BAT 3 Autumn	BAT 4 Summer	BAT 4 Autumn	BAT 5 Summer	BAT 5 Autumn	BAT 6 Summer	BAT 6 Autumn
Chalinolobus gouldii	Low	Med	Low		Low	Low			Low	Low		High
Falsistrellus Mckenziei				Low								Low
Mormopterus sp.									Low			
Nyctophilus geoffroyi					Low	Low		High	Low	Low		Low
Nyctophilus timoriensis major			Low		Low							
Tadarida australis	Low	Med		Low				Low		Med		High
Vespadelus regulus	Med	Med	Med		Med	Low		High	Med	Low	Low	Med
Subtotal of species detected	**3**	**3**	**3**	**2**	**4**	**3**	**Nil**	**3**	**4**	**4**	**1**	**5**

Genus-species	BAT 7 Summer	BAT 7 Autumn	BAT 8 Summer	BAT 8 Autumn	BAT 9 Summer	BAT 9 Autumn	BAT 10 Summer	BAT 10 Autumn	BAT 11 Summer	BAT 11 Autumn	BAT 12 Summer	BAT 12 Autumn
Chalinolobus gouldii	Low	Low	Low	Low	Low					Low	Med	High
Falsistrellus Mckenziei					Low		Low				Low	
Mormopterus sp.			Low	Low				Low		Low	Low	Low
Nyctophilus geoffroyi	Low		Low			Note 1	Low	Low	Low	Low	Low	Low
Nyctophilus timoriensis major					Med	Note 1	Low		Low		Low	Low
Tadarida australis				Med				Low		Low	Low	
Vespadelus regulus	Low	Low	Low	Low	Med	Low	Low	Med	Low	Low	Med	High
Subtotal of species detected	**3**	**2**	**4**	**4**	**4**	**2**	**4**	**4**	**3**	**5**	**7**	**5**

Note 1: Nyctophilus sp. were recorded during the survey but the sequences were low quality and the particular species could not be determined accurately.

Appendix 2. Summary of WAM FaunaBase Chiroptera listings for Study Area.

Genus-species	Nearest Site	Latitude	Longitude	Date	Number of vouchers
Chalinolobus gouldii	Lake Preston	32°57’40"S	115°43’30"E	22 Nov 1975	1
Falsistrellus Mckenziei	Lake Preston	32°57’40"S	115°43’30"E	22 Nov 1975	8
Pteropus scapulatus	16 km SW of Pinjarra	32°44’00"S	115°45’00"E	16 Dec 1990	1
Vespadelus regulus	Mandurah	32°33`00"S	115°42`00"E	17 Jan 1968	5
Vespadelus regulus	Lake Preston	32°57’40"S	115°43’30"E	22 Nov 1975	1
Vespadelus regulus	Mandurah	32°34`00"S	115°48`00"E	6 Mar 1983	1

Appendix 3. Summary of Bat Call WA Chiroptera listings for Study Area.

Site	Latitude	Longitude	Date	Habitat Type	Species Present
Nambeelup	32°30'S	115°50'E	Feb 2007	5	Cg, Ta, Vr
Near Guanamup Pool on Serpentine River	32°27'S	115°47'E	May + June 2004	5	Cg, Mp, Vr
Furnissdale	32°33'S	115°45'E	Dec 2006	5	Cg, Vr
Lake Clifton	32°45'S	115°39'E	May 2004	2	Cg, Vr
Lake Clifton	32°45'S	115°39'E	Oct 2004	2	Cg, Mp
Lake Clifton	32°50'S	115°40'E	Oct 2007	2	Cg, Ng, Vr
Preston Bch-Yarloop Road	32°55'S	115°44'E	Nov 2003	7	Cg, Fm, Mp, Ta, Vr
Preston Beach Road	32°55'S	115°42'E	Oct 2008	5	Cg, Fm, Mp, Ta
Myalup Beach Road	33°6'S	115°43'E	Oct 2008	5	Cg, Fm, Mp, Ng, Vr

Myalup Beach Road	33°6'S	115°43'E	Nov 2003	5	Cg, Fm, Mp
Myalup Beach Road	33°6'S	115°43'E	Dec 2007	5	Cg, Mp, Ng, Vr
Buffalo Rd – O'Reilleys Memorial	33°12'S	115°42'E	Nov 2003 & Nov 2008	3	Cg, Fm, Vr
Buffalo Rd – O'Reilleys Memorial	33°12'S	115°42'E	Dec 2007	3	Cg, Ng, Nt

Appendix 4. Summary of Other Chiroptera listings for Study Area.

Two reports containing records of bats from the study area were available from the DEC Library.

Alan Tingay and Associates (1998). Vertebrate Fauna; Lake Clifton Land Exchange Proposal.
A single sighting of a Chalinolobus gouldii was reported in June 1998. The location provided is consistent with heath and shrubland over a coastal dune system, habitat type 1 from this report.

Metcalf, B. and Bamford M.J. (2008). Faunal Assessment of the Proposed South Binningup Development.
Four species are listed as present in late March 2008. These are *Mormopterus sp*., *Nyctophilus sp*., *Tadarida australis* and *Vespadelus regulus*. The location for these records is consistent with medium mixed woodland, habitat type 2 from this report.