The use of the proposed sand mining area at Gwindinup by threatened species.

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A Quenda (Southern Brown Bandicoot) *Isoodon obesulus* trapped at Gwindinup

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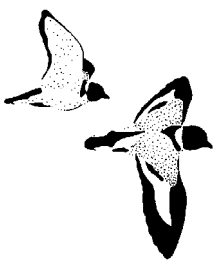

02/12/2004

Introduction

Cable Sands has proposed to expand its sand mining operations near Capel in the South-West of Western Australia to include a site at Gwindinup. The proposed mining at Gwindinup will involve the clearing of Jarrah forest and has the potential to impact upon populations of Chuditch *Dasyurus geoffroyi* and Western Ringtail Possum *Pseudocheirus occidentalis* in the area. Both are threatened species. In addition, two threatened species of cockatoo, the Long-billed or Baudin's Black-Cockatoo *Calyptorhynchus baudinii* and Short-billed or Carnaby's Black-Cockatoo *Calyptorhynchus latirostris*, may nest in the area. These species were identified in the area during surveys carried out in 1999 (Bamford Consulting Ecologists 2000), but additional work was requested by the Federal Department of Environment and Heritage (DEH) and the State Department of the Environment (DoE). The DoE also requested some additional information on the importance of the north Gwindinup area for fauna.

Methods

In order to assess the potential impact on Chuditch and Western Ringtail Possums, Bamford Consulting Ecologists were asked to assess the availability of appropriate habitat for each species, and conduct trapping (to gauge the numbers of Chuditch currently using the site) and spot-lighting (to gauge the numbers of Western Ringtail Possums currently using the site). To assess the availability of potential nesting sites for cockatoos and to search for nesting pairs, surveys of hollows were carried out both in proposed mining areas and in conservation areas. The North Gwindinup area was to be revisited and was to be included in all surveys.

- ***Chuditch survey***

To determine the abundance and distribution of the Chuditch in the Gwindinup area, fifty-two cage traps were deployed in a transect through the area, with intervals of 200m between traps. This trapping method is used by the WA Department of Conservation and Land Management (CALM) in the monitoring of species such as the Chuditch. Each trap was covered with a hessian bag and placed alongside or under logs or shrubs. Traps were baited with a mixture of peanut paste, rolled oats and sardines. The traps were open for four nights, 1st – 5th November, for a total of 208 trap-nights. The traps were checked every morning, and all traps were re-baited on the 3rd November. See Figure 1 and Appendix 1 for trap locations.

- ***Western Ringtail Possum survey***

To determine the abundance and distribution of the Western Ringtail Possum in the Gwindinup area, spotlighting was carried out in a transect that followed the Chuditch trapping transect (see above). In total, the transect was carried out three times over four nights. The transect was just over 10km in length. Spotlighting was done with one driver and at least one observer using a hand-held spotlight, travelling at a speed of *ca.* 10 kph. This approach of covering a considerable amount of habitat at a slow

speed in a vehicle was considered appropriate as previous work had indicated that the species occurs at a very low density in the area. More intensive techniques, such as spotlighting when on foot, would have been used if high densities of possums were found.

- ***Cockatoo hollows survey***

In order to assess the potential value of the Gwindinup area as breeding habitat for Short-billed and Long-billed Black-Cockatoos, several areas were surveyed for hollows potentially suitable for nesting by cockatoos. The search areas included:

- Happy Valley North - ore deposit
- Happy Valley North - state forest
- Happy Valley South - ore deposit
- Happy Valley South - state forest
- Gwindinup north - ore deposit
- Gwindinup north - south-east vegetation protection area
- Gwindinup north – Lot 107 CALM donation area

Searches were carried out by Robert Davis (Western Wildlife), Jennifer Wilcox (Western Wildlife), Brenden Metcalf, Veronica North (Bamford Consulting Ecologists), Brant Edwards (Cable Sands) and Alan Heptinstall (Cable Sands). Searches involved 3 to 4 people walking abreast through the forest, about 50m apart. All potential habitat trees within each search area were examined from the ground. Assessments of hollow suitability were made entirely on the entrance diameter of the hollows and did not take into account entrance aspect, hollow location (trunk or spout), etc., which are also likely to influence hollow occupation by cockatoos. Therefore, the number of hollows recorded is likely to be greater than the number that are likely to be actually suitable for use by the birds. Locations of potential habitat trees were recorded using a hand held GPS unit.

Opportunistic records of cockatoos using the site were also kept, and the species, location, number of birds and their activities were noted.

Results

- ***Chuditch survey***

No Chuditch were trapped during the monitoring period. The other fauna caught are listed in Table 1, and include the Quenda (Southern Brown Bandicoot) and Brush-tailed Possum. Details of fauna captured are in Appendix 4.

- ***Western Ringtail Possum survey***

No Western Ringtail Possums were observed during the spotlighting. Other species observed are listed in Table 2. Only Western Grey Kangaroos were observed in the northern half of the transect between Gavins Rd and Morris Rd. On the southern half

of the transect, between Gavins Rd and Gundagai Rd, Brush-tailed Possums, Brush Wallabies and Tawny Frogmouths were common.

No Western Ringtail Possum dreys were observed while walking through the forest during cockatoo hollow surveys, but hollows suitable for cockatoos (see Figure 1, Appendix 2) may also be suitable for possums.

- ***Cockatoo hollows survey***

The potential cockatoo nesting hollows identified in each area are illustrated in Figure 1. A total of 290 potential hollow bearing trees were recorded, all in Jarrah *Eucalyptus marginata*. Opportunistic sightings of cockatoos are listed in Table 3. Both Short-billed and Long-billed Black-Cockatoos were observed on the site, although sometimes birds were feeding in mixed flocks or flying quickly overhead, making recording the numbers of each species present difficult. On two occasions flocks of around 80 birds were observed (Table3). Birds were observed feeding on Bull Banksia *Banksia grandis*, Jarrah *E. marginata* and Marri *Corymbia calophylla* (Table 3).

Opportunistic records of birds other than cockatoos were also kept for the main areas surveyed for hollows (Appendix 3).

Discussion

- ***Chuditch***

The Chuditch was once widespread across Western Australia, occurring in a variety of habitats. It is currently only found in the South-West of Western Australia, and is listed as Vulnerable under the Commonwealth *Environment Protection and Biodiversity Conservation Act* (1999), the *WA Wildlife Conservation Act* (1950) and the Action Plan for Australian Marsupials and Monotremes (Maxwell *et al.* 1996).

Although once more widespread, Chuditch are currently found in habitats that contain sclerophyll forest (such as Jarrah forest) and woodlands (Strahan 1995). Much of the Gwindinup area consists of Jarrah forest suitable for occupation by Chuditch. Although no Chuditch were trapped during this survey, Bamford Consulting Ecologists (2000) caught 3 and 6 individuals respectively in surveys carried out in August and December 1999. The trapping effort on each occasion was 225 trap-nights, which is slightly more than the 208 trap-nights used in November 2004. The trap layout was different but covered the same general area. Although all numbers are low, this suggests that a decline in the local population of the Chuditch has occurred. A similar decline may have been documented in monitoring by CALM in the Whicher Range area, some 40km south-west of Gwindinup, where trapping in February 2002, July 2003 and May 2004 yielded captures of 11, 8 and 3 respectively (CALM data from Western Shield Faunafile, provided by M. Maxwell). Again, however, these numbers are low and seasonal differences may have contributed to the apparent decline. The sampling approach used by CALM was similar to that used at Gwindinup in November 2004, although with about 390 trap-nights in each survey.

While the Chuditch may have suffered a regional decline in abundance, it is very likely that the species still occurs in the Gwindinup area. Chuditch have been found to hold territories of about 55 to 120ha (females), or 400ha or more (males) and these territories may overlap (Strahan 1995), compared with the total area of impact of 117ha of native vegetation for all four mineral deposits. If a decline in abundance has occurred, there is no clear cause but some anecdotal reports of an increase in Fox numbers due to a reduction in baiting.

- ***Western Ringtail Possum***

Once widespread throughout the South-West forests, the Western Ringtail Possum has declined, with some populations becoming locally extinct. Most remaining Western Ringtail Possum populations are now in near-coastal areas, usually where the forest includes areas of peppermint trees *Agonis flexuosa* (Strahan 1995). The species' former range, however, included eucalypt woodlands and forests. The Western Ringtail Possum is listed as Vulnerable by the WA *Wildlife Conservation Act*(1950) and the Commonwealth *Environment Protection and Biodiversity Conservation Act* (1999).

Although no Western Ringtail Possums were observed in November 2004, one was observed during spotlighting in the 1999 survey, and this was in the north Gwindinup area (Bamford Consulting Ecologists 2000). There are few Peppermint Trees in the Gwindinup area, but Western Ringtail Possums have been found to hold relatively small territories of about 2.5ha in areas of eucalypt forest (Strahan 1995). In Peppermint and eucalypt woodland around Busselton, 40km west-south-west of Gwindinup, the species commonly occurs at densities of 1-3/ha and is readily encountered when spotlighting (M. Bamford, unpubl. data), so this suggests that the density of the species at Gwindinup is very low. Densities of 1-3/ha have been found when spotlighting on foot. The presence of the species is also readily revealed by dreys (nests) that can be present at densities of in excess of 5/ha. However, dreys are used in near coastal areas and tree hollows are important shelter for Western Ringtail Possums occurring more than 4km from the coast (Strahan 1995). In the Gwindinup area, tree hollows may be an important resource for possums, particularly as individual possums may use up to eight different rest sites during a year (Strahan 1995).

In the Busselton area, Western Ringtail Possums rely to a great extent on continuous or near-continuous canopy cover, especially of Peppermint trees, with possums preferring areas where dense understorey is present (Jones *et al.* 1994a). The canopy structure appears to be important as it allows the species to move around without having to descend to the ground where it is vulnerable to predation by Foxes. Very little of the forest at Gwindinup has continuous or near-continuous canopy, so it is probably of marginal quality for the species when Foxes are present.

- ***Short-billed Black-Cockatoo and Long-billed Black-Cockatoo***

A total of 290 potential nesting hollows were recorded in both mining and non-mining areas (Figure 1, Appendix 2). This list is not exhaustive although most of the areas proposed to be mined were surveyed.

Much of the forest in the Gwindinup area is secondary growth with few remaining large trees, so the area may not be as important breeding habitat as areas of older growth forest. Densities of potential nest hollows varied across the areas surveyed, however, with higher densities on some privately owned sites where logging has presumably been less intense (see Figure 1). Suitable nesting hollows are often a limiting factor for cockatoo populations, and the potential nesting hollows in the Gwindinup area are likely to be important for both Short-billed Carnaby's and Long-billed Black-Cockatoos in the area. Lack of published information makes it difficult to determine the value of the Gwindinup area to breeding cockatoos compared with surrounding areas.

Cockatoos were observed foraging in the Gwindinup area on four occasions (Table 3). Most of the native vegetation present in the area (such as *Eucalyptus* and *Banksia* species) is suitable for foraging cockatoos.

- ***Gwindinup North Area***

The Gwindinup North area was included in the 1999 surveys as Site 5 (Bamford Consulting Ecologists 2000). It differed from other sites in that the vegetation and soils marked a transition between two landform/vegetation types (Whicher #1 and Cartis). The area surveyed at Site 5 represented the best potential habitat for many of the native mammal species of interest within the Gwindinup North project area with a reasonable canopy of Eucalypts (jarrah and marri) and a mixture of Banksia as a midstorey. The current mine plan indicated in Figure 1 suggests the proponent will be largely avoiding this habitat. The majority of the site has been used for cattle grazing and blue gum plantations and offers little potential habitat for the species in question. This transition was characterised by sandy soils and a mixture of Banksia as a mid-storey with eucalypts (Jarrah and Marri) as an overstorey. There was also a seasonal wetland low in the landscape. Trapping and bird census results from 1999 do not indicate that the Gwindinup North area differs in its faunal assemblage from other sites, except for very large numbers of the Moaning Fog *Heleioporus eyrei* caught in December of that year. This reflects the juxtaposition of the seasonal wetland. The Gwindinup North area was the poorest in terms of mammal captures, but numbers of captures of all mammals were low across all five sites. It was, however, the only site where the Western Ringtail Possum (one individual) was observed. The density of potential nest trees for black-cockatoos in the Gwindinup North area was similar to the density found in other areas. The nest hollow survey in the Gwindinup North area concentrated o the most suitable habitat, with most of this area devoid of trees of suitable size and species. Overall, the Gwindinup North area does not appear to be distinctive for fauna except for its relationship with the nearby wetland. This would need to be considered during mining and rehabilitation.

Conclusions and recommendations

Although the Chuditch and Western Ringtail Possum were not recorded in the Gwindinup area in November 2004, both species were recorded in 1999. Both of these mammals are probably still present in the area or nearby , but probably in low numbers, and may have been adversely impacted by a possible increase in Fox numbers in the area.

Important issues for the Chuditch and Western Ringtail Possum include the availability of shelter (e.g. tree hollows) and the continuity of habitat. Fragmentation of forest areas makes it difficult for these species to disperse and can make them more vulnerable to predation by introduced predators.

The Gwindinup area is used by both Short-billed and Long-billed Black-Cockatoos for foraging. Although not observed breeding in November 2004, it is probable that one or both species nests in the area as potential nesting hollows appear to be available.

The Gwindinup North area does not appear to be distinctive for fauna except for its relationship with the nearby wetland. This needs to be considered during mining and rehabilitation. While part of the Gwindinup North area supports habitat consisting of large Jarrah with moderately healthy understorey, the majority is cleared or partly cleared and includes a substantial proportion of Blue Gum plantation.

In order to protect or enhance the viability of populations of threatened species in the Gwindinup area, the following recommendations are made:

- Continue or increase fox-baiting programmes
- Retain large trees with hollows where possible
- Retain as much native vegetation as possible, or if clearing is to occur, ensure that corridors of native vegetation (as wide as possible) connect patches of forest, and that no patches of forest are left isolated by cleared areas.
- Rehabilitation should aim to produce suitable habitat for threatened species and should be designed to enhance habitat linkages across the landscape.

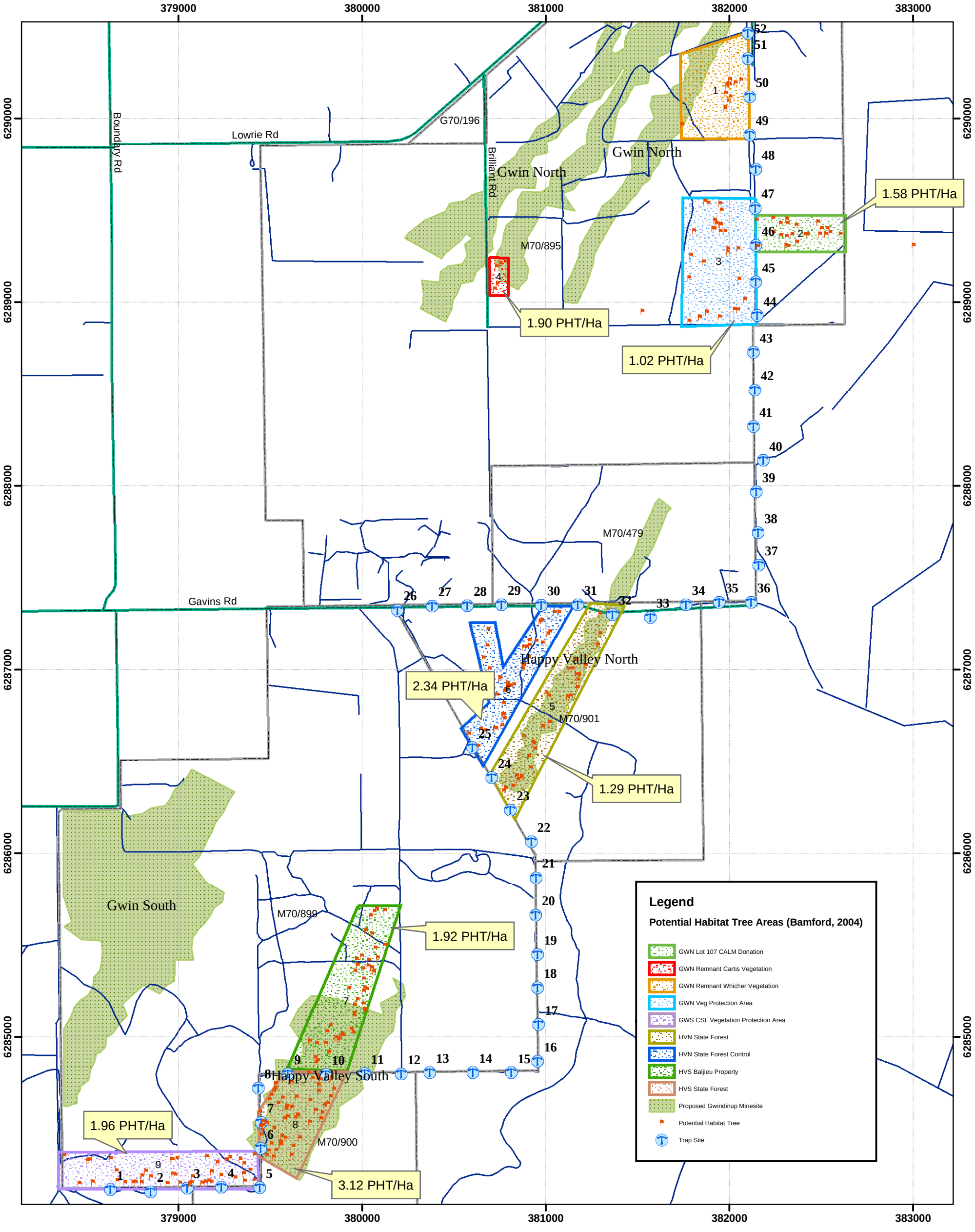

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Figure 1: CABLE SANDS GWINDINUP PROJECT HABITAT TREE LOCATION

Drawn : Todd Griffin

Table 1. Results of cage trapping.

Species	2-Nov	3-Nov	4-Nov	5-Nov
Quenda (Southern Brown Bandicoot) *Isoodon obesulus*	**2**	**1**		
Brush-tailed Possum *Trichosurus vulpecula*		**1**		
Bobtail *Tiliqua rugosa*	**1**	**3**	**3**	**4**

Table 2. Results of spot-lighting.

Northern transect from Gavins Rd to Morris Rd. Total distance: 5.1km		**Date: 1/11/2004**
2.8km	6 x Western Grey Kangaroo	Grazing in paddock

Northern transect from Morris Rd to Gavins Rd. Total distance: 5.1km		**Date: 1/11/2004**
Nothing seen		

Southern transect from Gavins Rd to Gundagai Rd. Total distance: 5.9km		**Date: 2/11/2004**
1.3km	2 x Brush-tailed Possum	In canopy of Jarrah
2.7km	1 x Brush Wallaby	Grazing on edge of Blue Gums
3.2km	4 x Western Grey Kangaroo	Grazing on edge of Blue Gums
4.2km	1 x Western Grey Kangaroo	Grazing on edge of Blue Gums

Table 2 (cont.).

Southern transect from Gundagai Rd to Gavins Rd. Total distance: 5.9km		**Date: 2/11/2004**
2.9km	2 x Western Grey Kangaroo	In Jarrah forest
3.1km	1 x Tawny Frogmouth	Perched in Jarrah
3.1km	2 x Brush-tailed Possum	In canopy of Jarrah
3.2km	3 x Brush-tailed Possum	In canopy of Jarrah
5.1km	1 x Brush-tailed Possum	In canopy of Jarrah

Northern transect from Gavins Rd to Morris Rd. Total distance: 5.1km		**Date: 3/11/2004**
2.8km	5 x Western Grey Kangaroo	Grazing in paddock

Southern transect from Gavins Rd to Gundagai Rd. Total distance: 6.0km		**Date: 4/11/2004**
0.0km	1 x Brush Wallaby	Grazing on edge of Blue Gums
1.0km	3 x Western Grey Kangaroo	Grazing on edge of Blue Gums
4.2km	3 x Brush-tailed Possum	In canopy of Jarrah
4.3km	1 x Tawny Frogmouth	In canopy of Jarrah
4.6km	1 x Tawny Frogmouth	On track
6.0km	1 x Tawny Frogmouth	In canopy of Jarrah

Table 3. Opportunistic sightings of Baudin's (Short-billed) Black-Cockatoo (BBC) and Carnaby's (Long-billed) Black-Cockatoo (CBC) in the Gwindinup area.

Date	Time	Northing	Easting	No. of birds	Notes
2/11/04	09:20	382093	6290454	c. 70 CBC	Flying overhead
2/11/04	12:40	6287343	380239	5 BBC	Feeding in Jarrah and *Banksia grandis*
3/11/04	09:30	382095	6290316	5 BBC	Flying overhead
3/11/04	11:05	6288980	381729	1 BBC	Flying overhead
4/11/04	09:20	6285278	380950	c. 20 BBC	Feeding in Marri and *Banksia grandis*
4/11/04	09:45	6284181	378348	c. 80 cockatoos (CBC?)	Feeding on ground in paddock and in Marri
4/11/04	11:00	6285680	380205	15 CBC (?)	Flying overhead
4/11/04	12:30	6284801	379583	c. 80 cockatoos – mixed flock of CBC + BBC	Feeding and roosting in Jarrah

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Appendix 1.

Locations of cage traps

Trap	Easting	Northing
1.	378639	6284186
2.	378856	6284173
3.	379055	6284195
4.	379240	6284198
5.	379447	6284196
6.	379454	6284407
7.	379455	6284551
8.	379440	6284736
9.	379601	6284811
10.	379805	6284808
11.	380017	6284815
12.	380215	6284812
13.	380370	6284820
14.	380604	6284819
15.	380812	6284818
16.	380955	6284880
17.	380960	6285079
18.	380954	6285280
19.	380955	6285459
20.	380944	6285673
21.	380945	6285877
22.	380920	6286072
23.	380807	6286242
24.	380706	6286417
25.	380600	6286583
26.	380195	6287327

Trap	Easting	Northing
27.	380382	6287350
28.	380574	6287351
29.	380759	6287356
30.	380973	6287354
31.	381173	6287356
32.	381361	6287304
33.	381565	6287289
34.	381758	6287356
35.	381939	6287370
36.	382113	6287369
37.	382153	6287570
38.	382151	6287744
39.	382139	6287969
40.	382177	6288138
41.	382124	6288322
42.	382131	6288520
43.	382125	6288725
44.	382146	6288924
45.	382138	6289105
46.	382136	6289305
47.	382135	6289506
48.	382136	6289716
49.	382103	6289904
50.	382104	6290110
51.	382095	6290316
52.	382093	6290454

Appendix 2.

Locations of hollow-bearing trees located within the Gwindinup area.

No.	Easting	Northing	No.	Easting	Northing	No.	Easting	Northing
1.	380634	6286584	41.	379649	6284681	81.	379420	6284232
2.	380731	6286682	42.	379735	6284783	82.	379368	6284228
3.	380722	6286682	43.	379852	6284724	83.	379186	6284221
4.	380764	6286697	44.	379834	6284684	84.	379175	6284226
5.	380777	6286735	45.	379818	6284648	85.	379156	6284223
6.	380827	6286916	46.	379789	6284598	86.	379137	6284217
7.	380803	6286911	47.	379780	6284565	87.	379071	6284214
8.	380799	6286909	48.	379487	6284543	88.	379016	6284217
9.	380874	6287004	49.	379549	6284648	89.	378949	6284215
10.	380909	6287064	50.	379572	6284678	90.	378809	6284220
11.	380899	6287119	51.	379620	6284763	91.	378775	6284223
12.	380880	6287121	52.	379754	6284610	92.	378763	6284219
13.	380910	6287131	53.	379667	6284460	93.	378719	6284220
14.	380910	6287156	54.	379630	6284415	94.	378675	6284229
15.	380983	6287142	55.	379468	6284530	95.	378544	6284221
16.	381013	6287194	56.	379571	6284468	96.	378471	6284214
17.	381022	6287208	57.	379526	6284515	97.	379365	6284322
18.	381071	6287312	58.	379592	6284618	98.	378515	6284340
19.	381047	6287312	59.	379595	6284633	99.	379398	6284286
20.	380671	6286668	60.	379715	6284812	100.	379361	6284267
21.	380765	6286754	61.	379839	6284786	101.	379317	6284245
22.	380774	6286758	62.	379801	6284640	102.	379239	6284257
23.	380772	6286816	63.	379721	6284548	103.	379188	6284278
24.	380776	6286881	64.	379620	6284367	104.	379084	6284249
25.	380781	6286892	65.	379806	6284971	105.	379079	6284219
26.	380792	6286905	66.	379966	6285364	106.	378990	6284260
27.	380794	6286924	67.	380008	6285377	107.	378977	6284265
28.	380753	6286952	68.	380036	6285394	108.	378858	6284249
29.	380751	6286956	69.	379751	6284894	109.	378832	6284281
30.	380882	6287026	70.	379824	6284923	110.	378810	6284256
31.	380881	6287022	71.	379874	6284991	111.	378670	6284283
32.	380948	6287153	72.	379899	6285014	112.	381856	6289211
33.	380968	6287261	73.	379945	6285047	113.	381944	6289526
34.	380980	6287268	74.	379957	6285030	114.	381951	6289490
35.	379485	6284366	75.	379961	6285120	115.	381913	6289391
36.	379497	6284390	76.	380012	6285187	116.	381987	6289265
37.	379511	6284429	77.	380011	6285257	117.	382048	6289113
38.	379586	6284566	78.	380029	6285267	118.	382022	6288952
39.	379601	6284575	79.	380067	6285362	119.	381777	6289123
40.	379620	6284626	80.	380125	6285506	120.	381786	6289246

Appendix 2 (cont.).

No.	Easting	Northing	No.	Easting	Northing	No.	Easting	Northing
121.	381801	6289378	161.	379501	6284668	201.	380049	6285663
122.	381880	6289528	162.	379512	6284692	202.	380069	6285687
123.	381862	6289539	163.	379527	6284714	203.	380083	6285704
124.	381950	6289411	164.	379535	6284728	204.	380127	6285693
125.	381945	6289415	165.	379535	6284756	205.	380075	6285490
126.	381946	6289376	166.	379766	6284794	206.	380041	6285424
127.	381972	6289375	167.	379777	6284776	207.	380055	6285383
128.	382475	6289428	168.	379768	6284749	208.	380057	6285384
129.	382359	6289408	169.	379769	6284713	209.	380055	6285383
130.	382311	6289418	170.	379723	6284663	210.	380089	6285437
131.	302308	6289441	171.	379654	6284583	211.	380012	6285321
132.	382272	6289420	172.	379641	6284569	212.	380020	6285273
133.	382231	6289446	173.	379589	6284457	213.	379980	6285211
134.	382141	6289436	174.	379562	6284438	214.	379964	6285180
135.	382525	6289390	175.	379566	6284423	215.	380016	6285155
136.	382494	6289392	176.	379561	6284425	216.	380021	6285150
137.	382336	6289359	177.	379537	6284393	217.	379961	6285134
138.	382306	6289347	178.	379525	6284357	218.	379895	6285021
139.	382275	6289354	179.	379421	6284370	219.	379882	6285000
140.	382233	6289372	180.	379343	6284345	220.	379862	6285003
141.	380771	6286340	181.	379289	6284353	221.	379763	6284881
142.	380780	6286356	182.	379269	6284342	222.	379755	6284870
143.	380843	6286421	183.	379220	6284325	223.	379657	6284585
144.	380908	6286529	184.	379160	6284359	224.	380584	6286651
145.	380883	6286636	185.	379000	6284348	225.	380647	6286677
146.	381017	6286857	186.	378976	6284343	226.	380732	6286861
147.	381002	6286875	187.	378970	6284345	227.	380706	6286915
148.	381122	6287002	188.	378640	6284348	228.	380697	6286936
149.	381144	6287003	189.	378527	6284341	229.	380701	6286962
150.	381156	6287052	190.	378388	6284365	230.	380696	6287004
151.	381281	6287133	191.	379720	6284985	231.	380663	6287062
152.	382027	6290182	192.	379757	6284971	232.	380683	6287127
153.	382059	6290197	193.	379810	6285035	233.	380687	6287219
154.	382000	6290105	194.	379832	6285067	234.	382542	6289372
155.	379459	6284477	195.	379934	6285270	235.	382598	6289360
156.	379463	6284505	196.	379979	6285395	236.	382518	6289361
157.	379455	6284524	197.	379973	6285428	237.	382485	6289360
158.	379452	6284527	198.	380001	6285446	238.	382420	6289359
159.	379467	6284549	199.	380057	6285567	239.	382407	6289359
160.	379451	6284603	200.	380025	6285583	240.	382361	6289317

Appendix 2 (cont.).

No.	Easting	Northing	No.	Easting	Northing	No.	Easting	Northing
241.	382316	6289295	281.	381834	6288910			
242.	382302	6289299	282.	381833	6288908			
243.	382993	6289301	283.	381906	6289390			
244.	382151	6289294	284.	381915	6289438			
245.	380851	6286401	285.	381987	6289281			
246.	380868	6286411	286.	382044	6289282			
247.	380867	6286418	287.	382078	6289006			
248.	380821	6286366	288.	382040	6288949			
249.	380984	6286692	289.	381942	6288911			
250.	381020	6286714	290.	381924	6289419			
251.	381119	6286852						
252.	381173	6286903						
253.	381175	6286942						
254.	381181	6286970						
255.	381165	6286970						
256.	381215	6287022						
257.	381293	6287196						
258.	381293	6287304						
259.	380917	6286465						
260.	380941	6286570						
261.	380935	6286596						
262.	380932	6286608						
263.	380985	6286689						
264.	381133	6286855						
265.	381997	6290199						
266.	381993	6290175						
267.	381997	6290172						
268.	381983	6290168						
269.	381975	6290125						
270.	381990	6290081						
271.	381972	6290050						
272.	381972	6290042						
273.	381738	6289955						
274.	380755	6289200						
275.	380732	6289185						
276.	380737	6289092						
277.	380723	6289060						
278.	361522	6288942						
279.	381777	6288888						
280.	381874	6288936						

Appendix 3.

Opportunistic records of bird species observed in the Gwindinup area.

Species	Happy Valley North	Happy Valley South	Gwindinup North Ore-body	Gwindinup North Veg. protection
Nankeen Kestrel			+	
Short-billed Black-Cockatoo		+	+	
Long-billed Black-Cockatoo			+	+
Red-tailed Black-Cockatoo	+			
Australian Ringneck	+			
Red-capped Parrot	+		+	
Western Rosella				+
Southern Boobook		+		
Sacred Kingfisher	+	+		
Laughing Kookaburra		+		+
Rainbow Bee-eater	+		+	+
Splendid Fairy-wren		+		
Striated Pardalote	+	+	+	
Weebill		+		+
White-browed Scrubwren		+		
Western Gerygone	+	+	+	+
Western Thornbill	+	+		
Inland Thornbill	+	+		+
Yellow-rumped Thornbill				+
Red Wattlebird			+	
Brown Honeyeater	+	+	+	
Western Spinebill	+	+	+	
Western Yellow Robin				+
Rufous Whistler				+
Grey Shrike-thrush		+		
Grey Fantail	+	+	+	+
Australian Magpie		+	+	
Australian Raven	+	+	+	+
Grey Currawong	+			
Silvereye	+	+		

Appendix 4.

Details of fauna captured in cage traps. See Figure 1 and Appendix 1 for details on trap locations.

Date	Trap	Species	Wt	Sex	Notes
2/11/04	37	*Isoodon obesulus*	1550g	M	
2/11/04	40	*Isoodon obesulus*	350g	F	Virgin pouch
2/11/04	48	*Tiliqua rugosa*			
3/11/04	23	*Isoodon obesulus*	100g	M	juvenile
3/11/04	24	*Trichosurus vulpecula*		M	Earmarked right ear, top position
3/11/04	46	*Tiliqua rugosa*			
3/11/04	46	*Tiliqua rugosa*			
3/11/04	50	*Tiliqua rugosa*			
4/11/04	24	*Tiliqua rugosa*			
4/11/04	15	*Tiliqua rugosa*			
4/11/04	30	*Tiliqua rugosa*			
5/11/04	29	*Tiliqua rugosa*			
5/11/04	34	*Tiliqua rugosa*			
5/11/04	38	*Tiliqua rugosa*			
5/11/04	41	*Tiliqua rugosa*			