

**THE VERTEBRATE FAUNA  
OF THE  
BODDINGTON GOLD MINE**



**Prepared for BGM Management Company Pty Ltd  
By Ninox Wildlife Consulting**

**April 2003**

## EXECUTIVE SUMMARY

This report has been prepared for BGM Management Company Pty Ltd (BGMMCo) and describes the results of a vertebrate fauna survey carried out over three seasons during 2001 and 2002. Previous studies in the BGM were undertaken during 1984, when three, seasonal surveys documented the vertebrate fauna of the area. Other, less intensive surveys have been undertaken between 1984 and 2001. As many of the original sampling locations no longer exist because of mine pits or dams, the primary objective of this 2001-2 study was to provide current baseline information on the BGM area by the establishment of vertebrate fauna sampling sites in the remaining representative vegetation communities. Using current methods, this included re-establishing sites in the three 1984 sites that were still accessible. These represented a Jarrah ridge site (B507J), a Wandoo/heath site (B501H/W) and a Wandoo/swamp site (B508S). An additional seven systematic sampling sites were to accurately represent the range of major fauna habitats which occur and, in part, to replicate some of the original 1984 sites that no longer exist.

The type of fauna survey methods applied in the 1984 baseline study have been improved over recent years and have been used extensively in the Boddington area; these methods were also used in this current study. Field work was carried out in spring (21 - 27 November 2001); autumn (23 - 28 March 2002); and winter (5 - 11 July 2002). Due to the large number of Chuditch (*Dasyurus geoffroii*) captured during this study, with several new animals being recorded in the final winter survey, it was decided to continue cage trapping in all 10 sites in an attempt to define the population of this species within the BGM study area. An additional two sites were also sampled in an effort to more accurately assess movement patterns through the area.

Eight native mammal species were recorded during this study. The most common animal trapped was the Chuditch with a total of 37 individuals. Several were captured in more than one site and many were trapped several times during the three sampling sessions. The two additional sampling sessions and sites resulted in the addition of 11 new animals. Of the 33 individual animals recaptured, 18 had moved between sites and in some cases, up to four sites had been visited. The longest movement was by a male which had moved approximately 4km. There appears to be no discernible pattern of habitat use or seasonality by either female or male Chuditch. The total of seven individual Wambengers (*Phascogale tapoatafa*) captured is also significant for this extremely elusive animal.

Because of the extremely dry autumn and winter experienced in 2001 and a similarly dry period in 2002, frogs were most affected by these conditions and any conclusions drawn in this report may be misleading. However, seven frogs were identified to species level and one additional species remains unconfirmed (*Heleioporus* sp.). Frogs were recorded in eight of the 10 sites, being absent only in two sites.

Sixteen reptile species were recorded during this study consisting of one Gecko, two Legless Lizards, one Dragon, nine Skinks, one Monitor, one Blind Snake and one Elapid (venomous) Snake. Only one species of Skink, *Lerista distinguenda*, was captured in every site. Ten of the 16 species were captured in less than half of the sampling sites, with four being recorded only from a single site. There does not appear to be any correlation between species richness and habitat type or position in the landscape. For example, the two sites with the highest species richness were the low-lying Wandoo site BG01 and the upper slope Jarrah site BG07.

Eighty-one species of native bird, comprising 40 Non-passerines and 41 Passerines, were recorded during this study. These included three rare, threatened or vulnerable birds and one covered by an international treaty. Of the total number of species recorded in the study area, 18 were noted only in opportunistic sites, mainly the freshwater lakes D1 and D4. This included 11 species of waterbird, two birds of prey, one heron, one spoonbill and one shorebird.

Sixty-three species of bird were recorded in the 10 systematic sites. The Western Spinebill was the only bird to be recorded in every site in every seasonal sampling period. The richest sites for birds over all seasons were Wandoo woodland sites BG01, BG05 and the Wandoo/heath site BG08 and the Jarrah/Banksia site BG03. All sites that included Wandoo as the main component of the upper vegetation stratum also had the highest abundance of individuals over the three sampling seasons.

In the community analysis based on Passerine birds, three Jarrah forest sites grouped together regardless of their understorey components. A second group consisted of Wandoo/ Swamp communities and two Wandoo sites also grouped together but separated from the Wandoo/Swamp sites. The two remaining Jarrah/Marri sites stood out as being distinct from all others.

Fourteen waterbirds were recorded using the D4 lake, including large aggregations of Hoary-headed Grebe (70 birds) and Eurasian Coots (66 birds), Australian Shelduck (26 birds) and Musk Duck (23 birds). Two birds of prey, the Peregrine Falcon and Swamp Harrier, were also recorded. Both of these birds feed on waterfowl.

Five introduced mammals were recorded during this study with Pigs being the most common feral animal. All other introduced species were uncommon, for example, only a single House Mouse (*Mus musculus*), and one Feral Cat (*Felis catus*) were captured during the whole study.

Extensive changes to sampling procedures have taken place since 1984, and several original sites no longer exist, therefore only presence/absence data have been used in comparisons with the 1984 results. Although captured in 1984, there is an apparent absence of dunnarts and pygmy-possums during 2001-2. However, the major change appears to be a large increase in population of larger, carnivorous marsupials such as the Common Wambenger and Chuditch. When analysed on an 'animals per 100 trapnights' basis, Common Wambengers have increased from a capture rate of 0.23 to 0.56 animals per 100 trapnights. However, the increase in population of Chuditch from 0.46 to 2.28 animals per 100 trapnights overshadows all other data. The presence of such a large population of Chuditch may have had an adverse impact on small mammal numbers. Two medium-sized mammals, the Southern Brown Bandicoot (*Isoodon obesulus fusciventer*) and Common Brushtail Possum (*Trichosurus vulpecula*), not recorded in 1984, were present during this current study.

While one species of frog (*Crinia glauerti*) was added to the BGM study area, six, mainly burrowing species, recorded during 1984 were absent during this current study. In part, this could be due to the preceding two dry winters having an effect on frog populations by limiting successful breeding. However, some swamps within the study area have been dramatically impacted through clearing for haul roads and others may have been indirectly

affected by changes to drainage patterns by road construction and maintenance. The main riparian system through the BGM, 34 Mile Brook, has been highly modified in sections as a result of damming for water supply. In addition, this stream passes through Wandoo woodlands that have been affected by the fungus *Armillaria*. The effect of this fungus on vertebrate and invertebrate animals and aquatic ecological processes through loss of canopy cover or other, unknown factors, is unknown. Only sampling following average or above average autumn rainfall will clarify this issue.

A total of 20 species of reptile were recorded in 1984 compared with 16 during 2001-2. However, two species were added to the inventory for the BGM study area: the legless lizard *Aprasia pulchella* and the Dugite (*Pseudonaja a. affinis*). These two species bring the total known from BGM to 22. While some reptiles such as Dell's Skink (*Ctenotus delli*) were known from only one site in 1984 and also in 2001-2, albeit a different site, others such as the small skink *Lerista distinguenda* were captured in very small numbers in only three sites in 1984, were captured in every site in 2001-2. The Common Dwarf Skink (*Menetia greyii*) was also much more common and widespread in 2001-2 than in 1984.

A total of 77 birds were recorded during 1984 and the subsequent sampling of waterbirds in 1991-2. This compares with 81 species recorded during this current study. While a substantial number of these birds are common to both studies, there is a range of birds that are unique to each sampling period. Ten species are unique to 1984 and 1991-2 and 14 are unique to 2001-2. This has resulted in a total of 91 birds known to occur at various times in the BGM study area. The vagaries of sampling or inherent scarcity of particular species are likely to account for many of the birds that were recorded only in 1984 or 2001-2, for example, five birds of prey, the Boobook Owl, Mistletoebird and Red-eared Firetail were unique to one of these sampling periods.

Four mammal, five bird and two reptile species listed as rare, threatened or vulnerable are known to occur within the habitats of the BGM. Of these, one bird and one reptile species recorded in 1984 were not recorded in 2001-2 and one mammal and one bird species not recorded in 1984 were recorded during this current study.

In the Boddington area, there has been historical disturbance to large areas of eastern Jarrah forest from farming and logging, and more recently from bauxite and gold mining. However, there are no areas dedicated to conservation in the Boddington region. Relatively large areas of forest within the BGM have been disturbed for mining, water storage, tailings dams and construction of infrastructure. However, the results from this current survey show that the remaining forest retains much of the vertebrate fauna that was recorded during initial studies in 1984. Some species have been added to the area inventory and some that were present in 1984 were not represented in the results from this current study. Most, if not all, of these changes are more likely to be due to natural variations in animal populations and their food and shelter requirements, reflecting changes in weather patterns over many years.

It is obvious from the results given in preceding sections of this document that areas of Wandoo woodland are highly significant to many species of animals, particularly birds. The trees provide a large number and variety of nesting and/or refuge hollows. When flowering, they are a rich source of nectar for honeyeaters and the leaves support a large biomass of invertebrates that provide a substantial food resource for leaf-gleaning birds.

The D4 Freshwater Lake has become an important local resource for relatively large numbers of waterfowl and a range of other birds dependent upon fresh water. This was particularly evident during this study which was conducted during an extended dry period in South-West Australia.

As there are no additional development proposals to be considered for this study, recommendations are limited to requirements for further effort to clarify issues that have arisen during the course of the work. Most obvious, is the potential for additional sampling following at least two years of relatively normal or above average rainfall. This would provide a more complete and current inventory of the vertebrate fauna of the BGM study area, particularly frogs.

More immediately, as many of the female Chuditch appeared to have lost body condition, and their pouch young, between the August and September/October sampling, it is recommended that further sampling of this species is undertaken in the near future to determine whether the population is in decline within the BGM and/or whether successful breeding had taken place.

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### LIST OF PARTICIPANTS

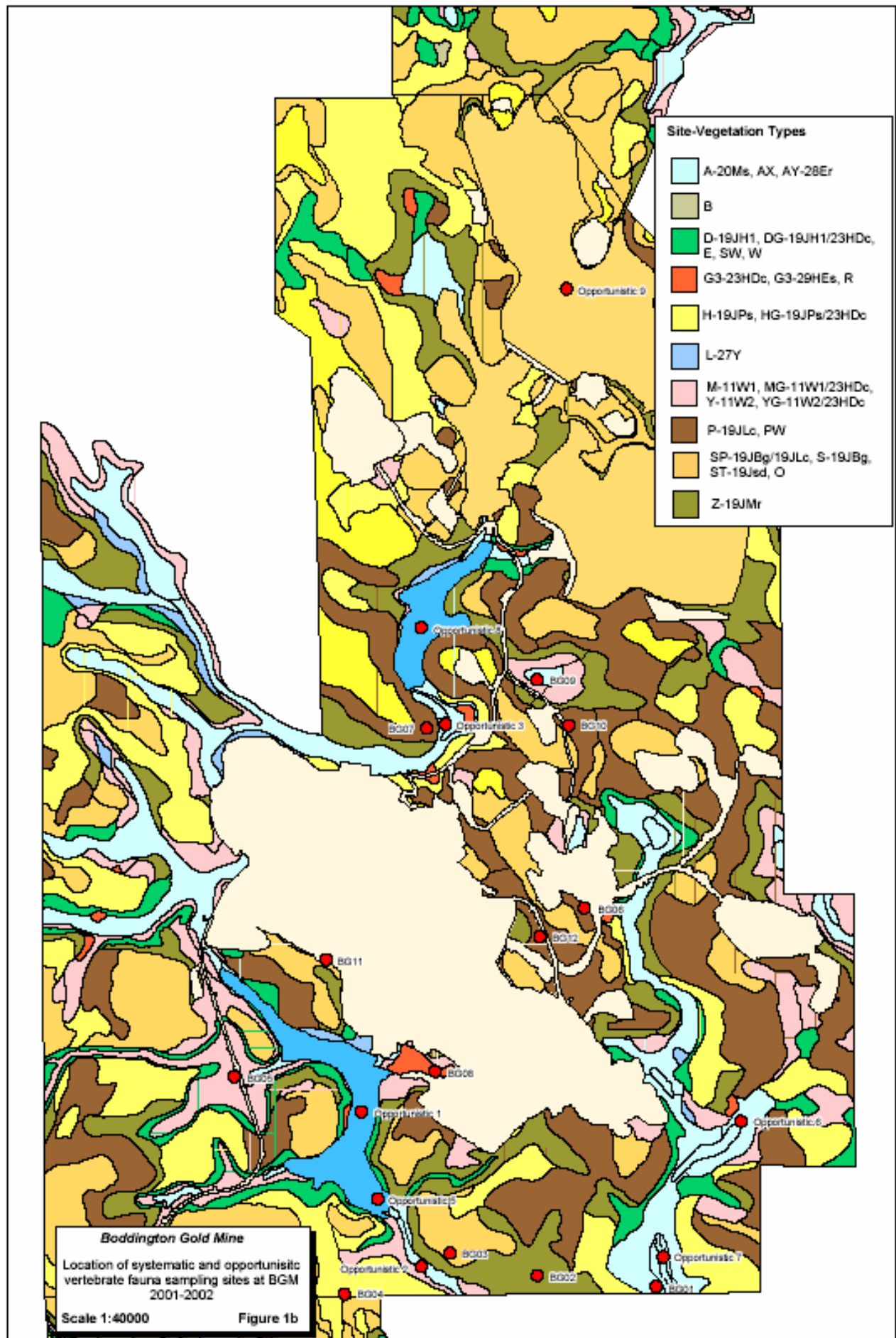
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|   | - Therese Wade        | Editorial comments   |

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Libby Mattiske of Mattiske Consulting Pty Ltd kindly checked and edited the vegetation community descriptions shown in Table 1.





## **1 INTRODUCTION**

This report has been prepared for BGM Management Company Pty Ltd (BGMMCo) and describes the results of a vertebrate fauna survey carried out over three seasons during 2001 and 2002. The survey took place within the Boddington Gold Mine (BGM) approximately 12 km north-west of Boddington, Western Australia.

Previous studies in the BGM were undertaken during 1984, when three, seasonal surveys documented the vertebrate fauna of the area (Worsley Alumina Pty Ltd 1999). Other, less intensive surveys have been undertaken between 1984 and 2001. These included assessments of waterbird use on D4 and D1 Freshwater Lakes (1987 and 1991 respectively). At this time, the Residue Disposal Area (F3) was also assessed for its impact on fauna, particularly birds. In 1992, an area of approximately 12km<sup>2</sup> that had not been included in the original baseline survey was targeted for future mining (Eastern Anomaly Area). A brief site inspection was carried out in order to determine the similarity of fauna habitats to those originally sampled and to assess the potential impact of mining. The results from these assessments are also documented in Worsley Alumina Pty Ltd (1999).

As many of the original sampling locations no longer exist because of mine pits or dams, the primary objective of this 2001-2 study was to provide current baseline information on the BGM area by the establishment of vertebrate fauna sampling sites in the remaining representative vegetation communities. Using current methods, this included re-establishing sites in some of the areas sampled during 1984 that were still accessible.

### **1.1 Study Objectives**

This study was initiated under BGMMCo Service Order No. 70021423 and the objectives of the survey were to:

- assess the vertebrate fauna occurring in the habitats of BGM and, where possible, compare these results with the 1984 surveys;
- assess the significance of the vertebrate fauna on a local and regional basis;
- conduct the survey systematically and document all methods used in order to provide a structure for reliable comparisons between habitats and to allow for future monitoring studies;

- assess fauna distribution and abundance through the various vegetation communities of the area;
- define locations of significance to vertebrate fauna;
- give particular attention to vertebrate fauna species declared “rare or otherwise in need of special protection” under the Wildlife Conservation Act 1950 (2002 amendment), species on the CALM “Priority List 2002”, and species listed under the Commonwealth Endangered Species Protection Act 1992 (May 2000 amendment);
- prepare a comprehensive report on the vertebrate fauna of the area.

## 1.2 Nomenclature, Taxonomy and Distribution Patterns

The following literature sources have been employed to discuss nomenclature, taxonomy, fauna distribution patterns and ecology in the preparation of this report:

**Birds:** Blakers *et al.* (1984); Johnstone & Storr (1998); Storr, G.M. (1991).

**Mammals:** Strahan (1998). **Bats:** Churchill (1998)

**Amphibians:** Tyler *et al.* (2000).

**Reptiles:** Cogger (1992); Storr *et al.* (1983); Storr *et al.* (1990); Storr *et al.* (1999); Storr *et al.* (2002); Wilson & Knowles (1988).

Other, more recent taxonomic revisions have been used when applicable. These are noted in text and listed in References.

## 2 METHODS

The type of fauna survey methods applied in the 1984 baseline study (Worsley Alumina Pty Ltd 1999) have been improved over recent years. Updated methods have been used extensively for Worsley Alumina Pty Ltd in Northern Saddleback during 1996-1997, Southern Saddleback in 1997-1998, Worsley Refinery Lease Area and Quindanning Timber Reserve in 2000-2001 (Ninox Wildlife Consulting 1997, 1998, 2001, 2002). For ease of reference, the sampling methods used in this current survey are described in detail in the following sections.

## 2.1 Systematic Sampling Site Choice

Of the eight original sites sampled in 1984, only three were still accessible for this current survey. These three sites represented a Jarrah ridge site (B507J), a Wandoo/heath site (B501H/W) and a Wandoo/swamp site (B508S).

An additional seven systematic sampling sites were chosen in consultation with BGM environmental staff and E.M. Mattiske of Mattiske Consulting Pty Ltd. These sites were distributed throughout the area to accurately represent the range of major fauna habitats which occur and, in part, to replicate some of the original 1984 sites that no longer exist.

Brief vegetation community descriptions and AMG grid references for all systematic sampling sites are presented in Table 1. Figure 1a and 1b show an aerial photograph and vegetation map respectively of the BGM study area, including the position of the 10 sampling sites which have the prefix "BG" in both of the Figures and throughout this report.

**Table 1** Sample site codes, vegetation descriptions and Australian Metric Grid references for the ten permanent sites established and sampled in the Boddington Gold Mine study area during November 2001, April and July 2002. (Where they coincide with new sites, original 1984 site code numbers are given in parentheses.)

| SITE CODE | VEG. CODE        | VEGETATION COMMUNITY  | AMG'S (AGD84)        |
|-----------|------------------|---|----------------------|
| BG01      | AY<br>(28Er+11W) | Open woodland of <i>Eucalyptus wandoo</i> and <i>Eucalyptus rudis</i> over <i>Hakea prostrata</i> , <i>Hypocalymma angustifolium</i> over grasses on gravelly clay.                     | 441 925<br>6 372 695 |
| BG02      | Z<br>(19JMr)     | Open forest of <i>Eucalyptus marginata</i> - <i>Corymbia calophylla</i> over <i>Macrozamia riedlei</i> , <i>Xanthorrhoea preissii</i> , <i>Hakea lissocarpa</i> on sandy gravel.        | 440 701<br>6 372 807 |
| BG03      | S<br>(19JBg)     | Open forest of <i>Eucalyptus marginata</i> - <i>Corymbia calophylla</i> over <i>Banksia grandis</i> , <i>Xanthorrhoea preissii</i> on rocky gravel.                                     | 439 795<br>6 373 036 |
| BG04      | H<br>(19JPs)     | Open forest of <i>Eucalyptus marginata</i> - <i>Corymbia calophylla</i> over <i>Hypocalymma angustifolium</i> on sandy gravel.  | 438 705<br>6 372 617 |
| BG05      | Y<br>(11W)       | Open woodland of <i>Eucalyptus wandoo</i> over <i>Hakea prostrata</i> and <i>Xanthorrhoea preissii</i> on gravelly clay.  | 437 569<br>6 374 859 |
| BG06      | P<br>(19JLc)     | Open forest of <i>Eucalyptus marginata</i> - <i>Corymbia calophylla</i> over <i>Allocasuarina fraseriana</i> and <i>Banksia grandis</i> over <i>Lasiopetalum floribundum</i> on gravel. | 441 183<br>6 376 605 |

| SITE CODE   | VEG. CODE              | VEGETATION COMMUNITY  | AMG'S (AGD84)        |
|---|------------------------|---|----------------------|
| BG07<br>(B507J)   | ST<br>(19JSd)          | Open forest of <i>Eucalyptus marginata</i> - <i>Corymbia calophylla</i> over <i>Allocasuarina fraseriana</i> , <i>Banksia grandis</i> and <i>Persoonia longifolia</i> over <i>Lasiopetalum cardiophyllum</i> on rocky gravel. | 439 559<br>6 378 461 |
| BG08<br>(B501H/W)   | G3<br>(23HDc + 11W)    | Open heath of <i>Dryandra squarrosa</i> , <i>Hakea incrassata</i> , <i>Hakea undulata</i> , <i>Gastrolobium spinosum</i> surrounded by open woodland of <i>Eucalyptus wandoo</i> on clay.                                     | 439 645<br>6 374 916 |
| BG09<br>(B508S)   | A<br>(30SMs + 11W)     | Open woodland of <i>Eucalyptus wandoo</i> over <i>Hakea prostrata</i> adjacent to swamp consisting of dense <i>Melaleuca lateritia</i> (Pillow Swamp and surrounds).  | 440 695<br>6 378 964 |
| BG10  | P<br>(19JLc)           | Open forest of <i>Eucalyptus marginata</i> - <i>Corymbia calophylla</i> over <i>Allocasuarina fraseriana</i> and <i>Banksia grandis</i> over <i>Lasiopetalum floribundum</i> on gravel.                                       | 441 024<br>6 378 491 |
| <b>ADDITIONAL SAMPLING SITES (August and September 2002 only)</b> |                        |   |                      |
| BG11  | P<br>(19JLc)           | Open forest of <i>Eucalyptus marginata</i> - <i>Corymbia calophylla</i> over <i>Allocasuarina fraseriana</i> and <i>Banksia grandis</i> over <i>Lasiopetalum floribundum</i> on gravel.                                       | 438 520<br>6 376 070 |
| BG12  | P/S<br>(19JLc + 19JBg) | Open forest of <i>Eucalyptus marginata</i> - <i>Corymbia calophylla</i> over <i>Allocasuarina fraseriana</i> and <i>Banksia grandis</i> over <i>Lasiopetalum floribundum</i> on gravel.                                       | 440 725<br>6 376 310 |

Sites were positioned such that two teams could efficiently undertake all systematic sampling in the morning to ensure that trapped animals were released as soon as possible and to coincide with the period when bird activity is highest. Two teams of two personnel were used to assess the 10 sites; one member of each team was responsible for trapline clearance, identification and safe release of fauna and the second carried out bird sampling.

## 2.2 Field Sampling

Field work for this study was carried out over three seasons: spring (21 - 27 November 2001); autumn (23 - 28 March 2002); and winter (5 - 11 July 2002). All of the information gathered was logged on to field data sheets and these data, consisting of nearly 3000 records have been transcribed to a project database which has been thoroughly checked for accuracy. All of the systematic techniques used during this survey have been summarised in Table 2.

**Table 2** Summary of fauna sampling effort undertaken in the 10 systematic sampling sites in the Boddington Gold Mine during 2001-2002.

| SAMPLING METHOD                   | TRAP-NIGHTS  | SAMPLING METHOD                      | HRS        |
|-----------------------------------|--------------|--------------------------------------|------------|
| Pit traps                         | 2,400        | Bird area search (minimum)           | 150        |
| Elliott traps                     | 4,800        | Hand-foraging (minimum)              | 130        |
| Cage traps                        | 2,400        | Searching for possum scats (minimum) | 30         |
| <b>Total number of trapnights</b> | <b>9,600</b> | Bird nest search (minimum)           | 30         |
|                                   |              | <b>Total number of search hours</b>  | <b>340</b> |

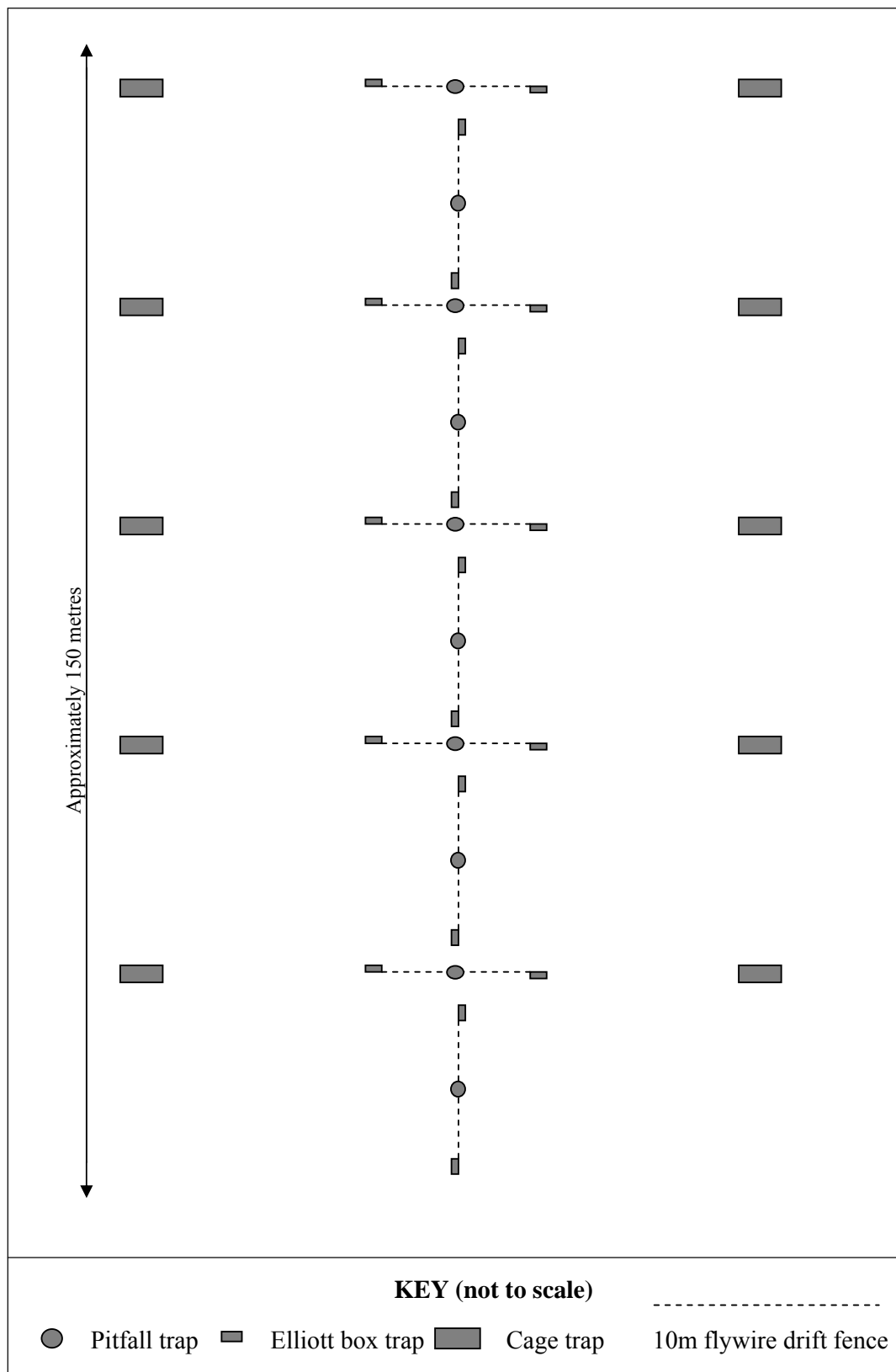
### 2.3 Systematic Sampling - Terrestrial Vertebrates

Traplines were positioned within the 10 sampling sites and each one consisted of 10 pitfall traps, bisected across the top by 10 metres of flywire drift fence 300mm high. Two medium Elliott box traps were placed on each drift fence (20 traps in total) and five wire cage traps were set on each side of the pit trap line at alternate traps (10 traps in total). Figure 2 shows this layout of traps. All box and cage traps were baited with universal bait, which consists of a mixture of peanut paste, rolled oats, tuna, sardines, sultanas, vegetable oil, honey and yeast extract.

Traplines were monitored over six consecutive nights during each seasonal survey and were checked each morning. Captured animals were identified, temporarily marked by fur clipping (small native mammals), or by an individually numbered ear tattoo (larger mammals). All details were recorded on field data sheets and animals were immediately released near their point of capture.

Intensive diurnal hand-foraging for small mammals and reptiles was conducted within each sampling site (Table 2). Hand foraging included raking leaf litter and loose soil, checking under logs and rocks and removing loose bark from logs and dead trees. Accessory information such as breeding activity, age, sex and micro-habitat for each animal was also noted. In addition to hand-foraging, approximately 30 personnel hours was spent specifically checking sites for evidence (mainly scats) of medium-sized mammals, particularly possums, and during the spring survey, each site was intensively searched for bird nesting activity. All terrestrial vertebrates observed active during the bird sampling periods were also systematically recorded. This included kangaroos, wallabies and reptiles.





**Figure 2** *Layout of terrestrial fauna traplines used in the 10 systematic sampling sites during the 2001-2002 baseline survey of the Boddington Gold Mine.*



**Plate 1 Fauna sampling site BG01**



**Plate 2 Fauna sampling site BG02**



**Plate 3 Fauna sampling site BG03**



**Plate 4 Fauna sampling site BG04**



**Plate 5 Fauna sampling site BG05**



**Plate 6 Fauna sampling site BG06**



**Plate 7 Fauna sampling site BG07**



**Plate 8 Fauna sampling site BG08**



**Plate 9 Fauna sampling site BG09**



**Plate 10 Fauna sampling site BG10**



**Plate 11 Fauna sampling site BG11**



**Plate 12 Fauna sampling site BG12**

### **2.3.1 Additional Sampling**

Due to the large number of Chuditch (*Dasyurus geoffroii*) captured during this study, with several new animals being recorded in the final winter survey, it was decided to continue cage trapping in all 10 sites in an attempt to define the population of this species within the BGM study area. An additional two sites were also sampled in an effort to more accurately assess movement patterns through the area (BG11 and BG12 described in Table 1).

Two sampling sessions were conducted, the first between 13 and 19 August 2002 and the second between 27 September and 3 October 2002. This added 1,440 cage trap nights, bringing the total number of cage trap nights to 3,840. The results of these two sampling sessions have not been shown in Appendix 1 but are discussed in detail in Section 3.1.3.

## **2.4 Systematic Sampling - Birds**

Bird sampling was based on 'area searches', a systematic survey technique consisting of a thorough avifaunal assessment within each of the 10 representative sites. Sampling was undertaken for approximately 40 minutes in each site, each morning for five consecutive days in each season (Table 2 shows total sampling effort). An experienced bird observer remained within the boundaries of the vegetation community or complex defined for each site and recording took place between 0700 hours and 1200 hours. Sampling times for each site were sequenced later each day to minimise variations in weather conditions and the peak activity periods of birds. The BGM study area was divided into two sectors and observers were rotated daily between each set of sites to reduce individual recording biases.

Observers moved slowly through each habitat and recorded all bird species seen or heard on field data sheets. Accessory information such as breeding activity, feeding behaviour and plant species utilised was also logged.

While systematically monitoring a site over five days, it is inevitable that some birds will be recorded on several occasions. Examples are highly territorial birds such as Fairy-wrens, inquisitive species such as Grey Fantails which sometimes follow the observer, breeding birds or flocking species such as cockatoos and Tree Martins which may remain in a localised area for an extended period. This over-recording unavoidably results in an exaggerated figure of relative abundance for some species. To overcome this difficulty, the daily data from each site over the three surveys were scanned to ascertain the specific day in each season when the highest number of individuals for every species in each



site was recorded. The total for this day was selected as being a reliable index of the relative abundance of birds on a site by site and seasonal basis.

## 2.5 Opportunistic Sampling - All Vertebrates

A number of sites not sampled systematically were thoroughly assessed opportunistically during the three seasonal surveys. These locations represented areas not suitable for trapping, either because of their small size, their inaccessibility, or their lack of representation of the general area. However, they were deemed sufficiently important to gain a more complete inventory of vertebrate fauna and to assess whether more intensive survey work would be required at a later stage. The two artificial Freshwater Lakes (D1 and D4) and the Residue Disposal Area (F3) were also included as opportunistic sites. Table 3 lists the sites sampled opportunistically during the course of this study.

*Table 3 List of Opportunistic Sites sampled during the 2001-2 study of the BGM.*

| <b>SITE CODE</b> | <b>DESCRIPTION</b>                        | <b>AMG'S (AGD84)</b> |           |
|------------------|---|----------------------|-----------|
| OP1              | D4 Freshwater Lake and shoreline          | 438 800              | 6 374 500 |
| OP2              | 34 Mile Brook (bat trap site)             | 439 500              | 6 372 900 |
| OP3              | Boomerang Swamp                           | 439 750              | 6 378 500 |
| OP4              | Not sampled                               | -                    | -         |
| OP5              | D4 dam wall, infrastructure and surrounds | 439 050              | 6373 600  |
| OP6              | Wandoo woodland on Roberts Road           | 442 800              | 6 374 400 |
| OP7              | Swamp adjacent to BG01                    | 442 000              | 6 373 000 |
| OP8              | D1 Freshwater Lake and shoreline          | 439 500              | 6 379 500 |
| OP9              | F3 Residue Storage Area                   | 441 000              | 6 383 000 |

Team members were proficient in all faunal groups and recorded opportunistic sightings of fauna while in the course of other activities such as trapline clearing or driving between sample sites. Any identifiable signs such as tracks, diggings and scats were also recorded. Species identification and habitat information were logged on data sheets and this information was used in the production of a comprehensive inventory of species observed in the BGM study area.

As bats cannot be sampled effectively in every individual vegetation community, a bat trap (harp trap) was set in the vicinity of 34 Mile Brook between sites BG03 and BG04 for a total of 10 nights during this study.

### 3 RESULTS AND DISCUSSION

#### 3.1 Native Mammals

Eight native mammal species were recorded during this study (Appendix 1). This result comprised one monotreme (Echidna), three dasyurids (Chuditch, Wambenger and Mardo), one bandicoot, one possum and two macropods (kangaroos and wallabies). Four of these species are considered rare, threatened or vulnerable and are discussed in detail in Section 4.2.

The most common animal trapped was the Chuditch (*Dasyurus geoffroii*) with a total of 37 individuals (36 marked with an ear tattoo). Several were captured in more than one site and many were trapped several times during the three sampling sessions. As stated in Section 2.4.1, two additional sessions were conducted within the BGM concentrating on this species, with the addition of two more sites within the mining area to attempt to more accurately assess their movement patterns. These additional sampling sessions resulted in the addition of 11 new animals. A more detailed discussion of capture/recapture rates, population levels and movement of Chuditch are discussed in Section 3.1.3.

##### 3.1.1 Species Richness

A maximum of six mammal species were recorded in two of the 10 sites (BG02 and BG08) and a minimum of three was recorded in two sites (BG04 and BG10). There appears to be no discernible pattern of species richness to habitat type within the BGM study area.

Only two mammals, the Chuditch and Western Grey Kangaroo (*Macropus fuliginosus*), were recorded in every site. The Mardo (*Antechinus flavipes*) was recorded in six of the 10 sites, with no apparent pattern in its distribution through the BGM.

The Southern Brown Bandicoot (*Isodon obesulus fusciventer*) was recorded in five of the 10 sites. This animal was only recorded in one site (BG09 – Wandoo/swamp) in all three seasons. It was captured in two of the three seasons in the Wandoo/heath site BG08 and only in a single season in Jarrah sites BG02, BG06 and BG07. The elusive and difficult to trap Common Wambenger (*Phascogale tapoatafa*) was captured in four of the 10 sites. Two of these sites were Wandoo woodlands (BG01 and BG05) and two were Jarrah forest (BG04 and BG06).

### 3.1.2 *Abundance*

The Western Grey Kangaroo was the most abundant animal recorded in many sites. The abundance of small to medium-sized mammals captured in the 10 sites was almost completely dominated by the carnivorous marsupial, the Chuditch (Appendix 1). A maximum of seven Chuditch were captured in site BG05; five animals were captured in sites BG03 and BG10; four animals from sites BG06, BG08 and BG09, three animals from BG04 and BG07, and two animals were captured in site BG01. However, there was a large amount of movement between sites and large numbers of recaptures. These aspects are discussed in more detail in Section 3.1.3. No new Chuditch were trapped in site BG02, although animals first recorded from site BG01 and BG03 were subsequently captured in this site.

The Common Wambenger was relatively abundant in sites BG06 and BG05 with three and two animals respectively. This species was also recorded from sites BG01 and BG04 with only a single animal from each site. The total of seven individuals captured is significant for this extremely elusive animal, indicating that the population within the BGM study area was particularly high.

Mardo captures were also very seasonal, with none in spring, small numbers in autumn marginally higher numbers in winter in sites BG03, BG05, BG02 and BG08, (4, 3, 2 and 2 respectively). While usually more common in swamp or wetland areas, no Mardos were captured in site BG09 (Pillow Swamp).

### 3.1.3 *Chuditch*

Appendix 2 shows all of the Chuditch capture, recapture and movement of individuals between sites for the spring, autumn and winter 2001-2 surveys within the 10 systematic sites at the BGM. The results from the two additional cage trapping sessions conducted between 13 - 19 August 2002 and 27 September - 3 October 2002 at the BGM are also shown. One female captured in trip 1 that was not marked with an ear tattoo has not been used in the following discussion.

A total of 47 Chuditch, twenty-two females and 25 males, were marked with an ear tattoo and are listed in Appendix 2. The capture sites for all of these individuals are shown on an aerial photograph in Appendix 3. Fifteen individuals were captured in trip 1; 13 were added during trip 2; 10 in trip 3; seven in trip 4 and two in trip 5 (Table 4). The rate of accumulation of new individuals is shown in Figure 3. The results shown in this accumulation graph indicate that the total population of Chuditch within the BGM study area had not yet been recorded.



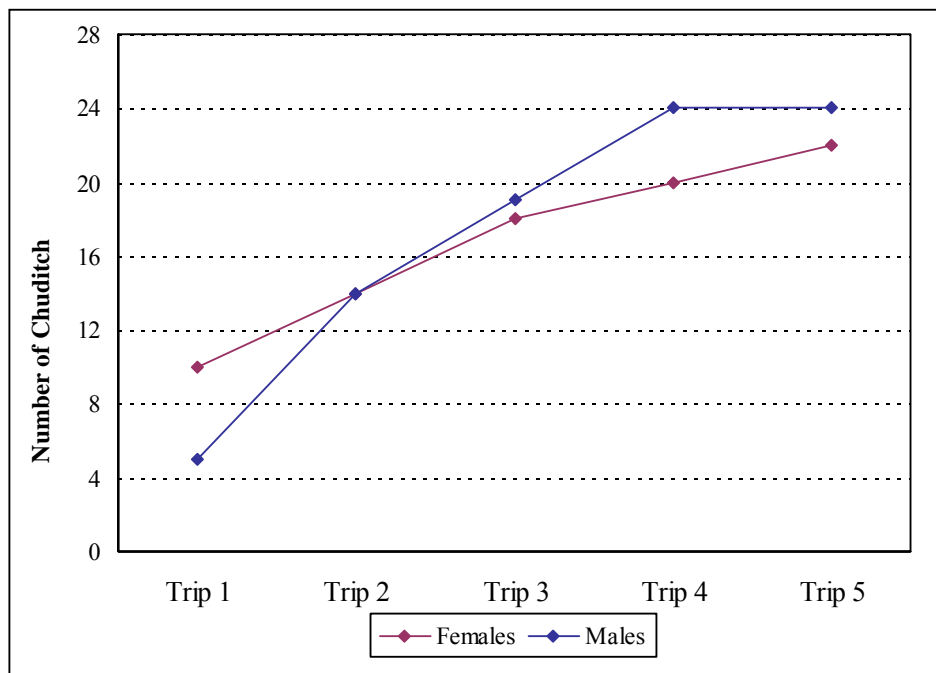
**Table 4** *Accumulation of male and female Chuditch individuals to all sites in five surveys within the BGM study area during 2001-2. (These results do not include the unmarked female from BG07 in trip 1.)*

| Site Code                       | Sex | Trip Number |           |           |          |          |
|---------------------------------|-----|-------------|-----------|-----------|----------|----------|
|                                 |     | 1           | 2         | 3         | 4        | 5        |
| BG01                            | F   |             | 1         |           |          | 1        |
|                                 | M   |             | 1         |           |          |          |
| BG02                            | F   |             |           |           |          |          |
|                                 | M   |             |           |           |          |          |
| BG03                            | F   | 3           |           |           | 1        |          |
|                                 | M   | 1           | 1         |           | 1        |          |
| BG04                            | F   | 1           |           |           |          |          |
|                                 | M   |             | 2         |           |          |          |
| BG05                            | F   | 1           | 1         |           | 1        |          |
|                                 | M   | 2           | 3         |           |          |          |
| BG06                            | F   |             |           | 1         |          | 1        |
|                                 | M   |             |           | 3         | 1        |          |
| BG07                            | F   | 1           |           |           |          |          |
|                                 | M   |             |           | 1         |          |          |
| BG08                            | F   | 2           |           | 1         |          |          |
|                                 | M   | 1           |           |           | 2        |          |
| BG09                            | F   | 1           | 1         | 1         |          |          |
|                                 | M   |             |           | 1         |          |          |
| BG10                            | F   |             | 1         | 1         |          |          |
|                                 | M   | 1           | 1         | 1         | 1        |          |
| BG11                            | F   | Not sampled |           |           | 1        |          |
|                                 | M   | Not sampled |           |           |          |          |
| BG12                            | F   | Not sampled |           |           | 1        |          |
|                                 | M   | Not sampled |           |           |          |          |
| <b>Total No. of Individuals</b> |     | <b>14</b>   | <b>12</b> | <b>10</b> | <b>9</b> | <b>2</b> |

It can be seen from Table 4 that although two new females were added to the two new sites (BG11 and BG12) in trip 4, seven additional animals (5 males and two females) were trapped in previously sampled sites (BG03, BG05, BG06, BG08 and BG10). In trip 5, the two new females were also captured in sites that had been sampled in all four previous trips (BG01 and BG06).



**Plate 13** *Chuditch being released at point of capture within the BGM study area during 2001-2.*



**Figure 3** *Accumulation of male and female Chuditch individuals to all sites in five surveys within the BGM study area during 2001-2.*

It can be seen from Figure 3 that the number of females initially captured in trip 1 exceeded the number of males (10 females to four males). From this point forward, the rate of accumulation of males was greater than of females, although by trip 5 only new females were added.

It was noted that by trip 5, many of the females that had had very small (between approximately 1 and 4 cm), hairless, pouch young when trapped in trip 3 and 4, had no young by trip 5. Insufficient time had passed for these young to have matured to the stage of being left in a nest; therefore, it is possible that these females had lost their young. Several animals were also in very poor condition and some had sustained injuries, possibly from fighting. The loss of young and evidence of fighting could indicate a level of stress from population levels that are too high for the available resources.

The capture/recapture rate of males and females within the 12 sites is shown in Table 5 and these data have been graphed in Figures 4a and 4b. The actual number of males and females individually marked within each site is also shown. Aerial photographs of the BGM study area and the movement between sites of 10 males and eight females that were recaptured in sites other than their original trapping site are shown in Figures 5a and 5b respectively.

Appendix 2 shows that thirty-three animals (17 females and 16 males) were captured more than once. The maximum number of captures was female L86, with 12 captures over three surveys (trips 1, 2 and 5). Females L87 and L96 were also captured several times (nine and eight captures respectively). Female L87 was captured in trips 1, 2 and 5; female L96 was captured in trips 1, 2, 3 and 5. Only one male, R16, was captured at a similar rate, with nine captures during trips 3 and 4.

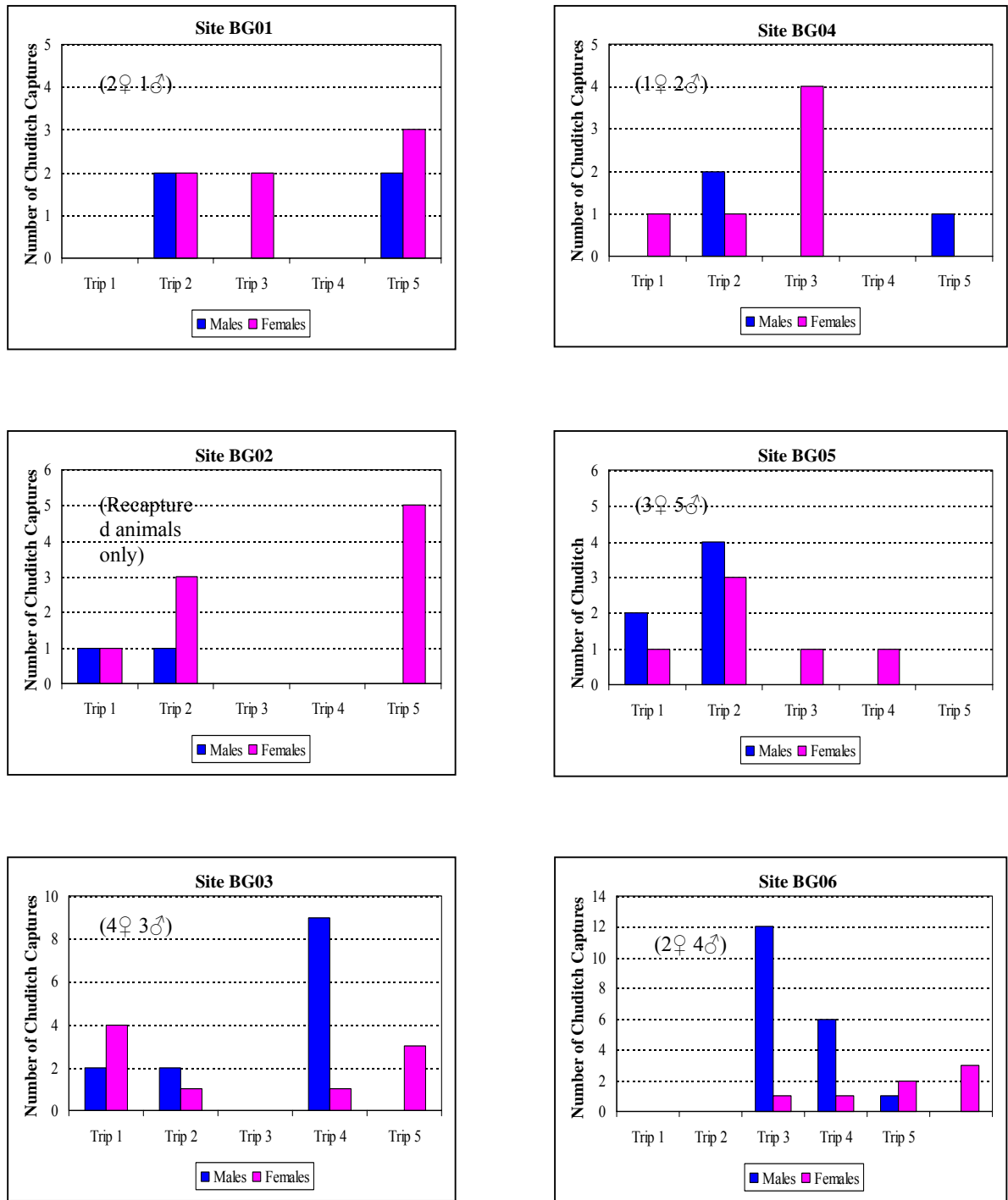
Of the 33 animals recaptured, 18 had moved between sites (eight females and 10 males) and in some cases, up to four sites had been visited (male R85). The longest movement was by male R12. This animal moved from site BG05 to BG06, a distance of approximately 4 km. However, it can be seen from Figure 5a that this direct route transected deep mine pits and the D4 Freshwater Lake, therefore, it is likely that this animal traveled a greater distance than shown on Figure 5a. Male R06 traveled approximately 3.5 km between sites BG01, BG02 and BG08.

There appears to be no discernible pattern of habitat use or seasonality by either female or male Chuditch. However, Table 5 shows that females were recaptured at a greater rate than males in all sites except BG03, BG06 and BG10.

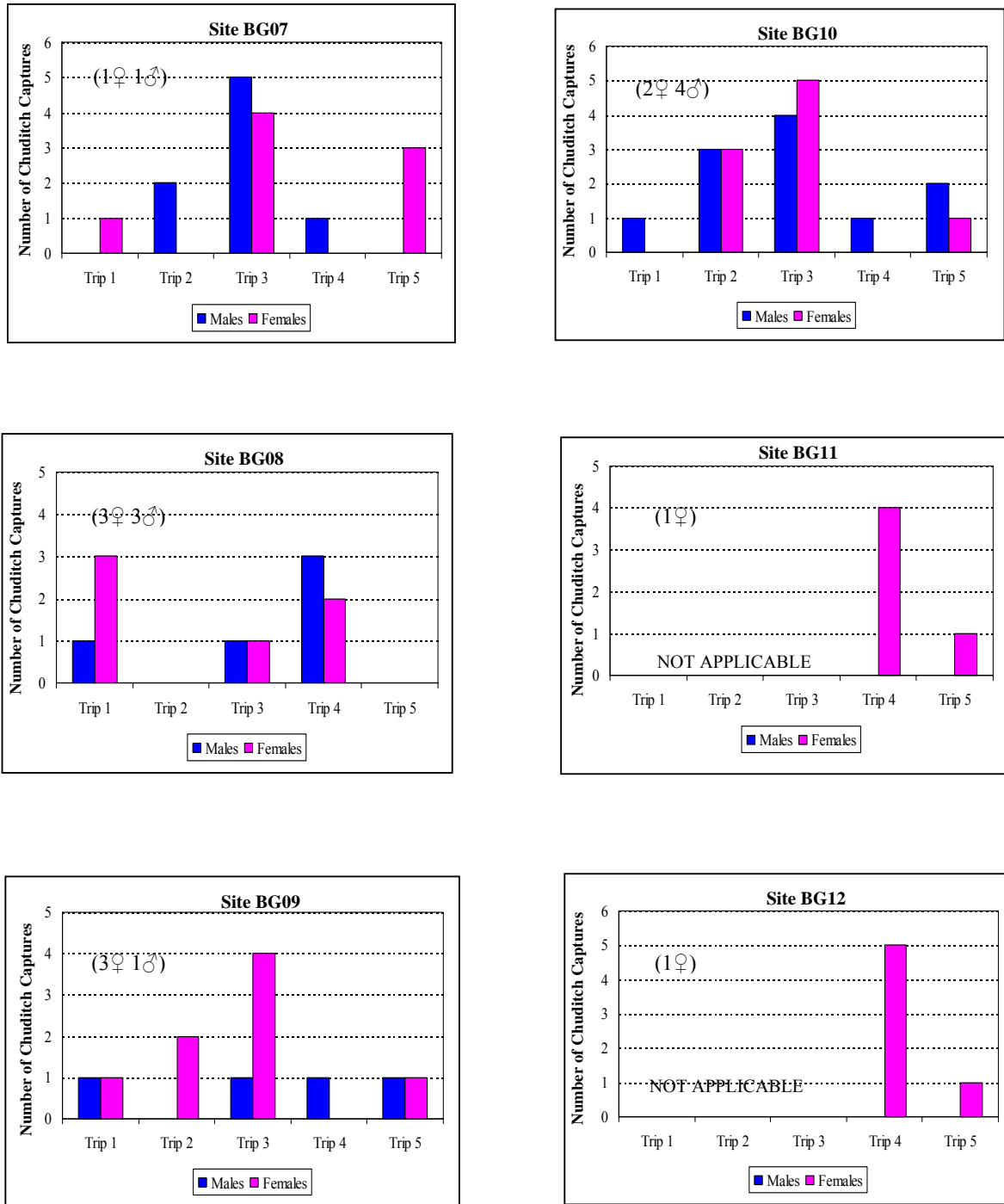
**Table 5** Capture/recapture data for female and male Chuditch during the 2001-2 survey of the BGM study area.

| CHUDITCH  |        |           |           |           |           |
|-----------|--------|-----------|-----------|-----------|-----------|
| Site Code | Trip # | Females   |           | Males     |           |
|           |        | Cage Trap | Recapture | Cage Trap | Recapture |
| BG01      | 2      | 1         | 1         | 1         | 1         |
|           | 3      |           | 2         |           |           |
|           | 5      | 1         | 2         |           | 2         |
| BG02      | 1      |           | 1         |           | 1         |
|           | 2      |           | 3         |           | 1         |
|           | 5      |           | 5         |           |           |
| BG03      | 1      | 3         | 1         | 1         | 1         |
|           | 2      |           | 1         | 1         | 1         |
|           | 4      | 1         |           | 1         | 8         |
|           | 5      |           | 3         |           |           |
| BG04      | 1      | 1         |           |           |           |
|           | 2      |           | 1         | 2         |           |
|           | 3      |           | 4         |           |           |
|           | 5      |           |           |           | 1         |
| BG05      | 1      | 1         |           | 2         |           |
|           | 2      | 1         | 2         | 3         | 1         |
|           | 3      |           | 1         |           |           |
|           | 4      | 1         |           |           |           |
| BG06      | 3      | 1         |           | 3         | 9         |
|           | 4      |           | 1         | 1         | 5         |
|           | 5      | 1         | 1         |           | 1         |
| BG07      | 1      | 1         |           |           |           |
|           | 2      |           |           |           | 2         |
|           | 3      |           | 4         | 1         | 4         |
|           | 4      |           |           |           | 1         |
|           | 5      |           | 3         |           |           |
| BG08      | 1      | 2         | 1         | 1         |           |
|           | 3      | 1         |           |           | 1         |
|           | 4      |           | 2         | 2         | 1         |
| BG09      | 1      | 1         |           |           | 1         |
|           | 2      | 1         | 1         |           |           |
|           | 3      | 1         | 3         | 1         |           |
|           | 4      |           |           |           | 1         |
|           | 5      |           | 1         |           | 1         |
| BG10      | 1      |           |           | 1         |           |
|           | 2      | 1         | 2         | 1         | 2         |
|           | 3      | 1         | 4         | 1         | 3         |
|           | 4      |           |           | 1         |           |
|           | 5      |           | 1         |           | 2         |
| BG11      | 4      | 1         | 3         |           |           |
|           | 5      |           | 1         |           |           |
| BG12      | 4      | 1         | 4         |           |           |
|           | 5      |           | 1         |           |           |





**Figure 4a** *Number of captured and recaptured Chuditch in six (BG01-BG06) of the 12 sites surveyed five times within the BGM during 2001-2. Capture/recapture data for individual animals are shown in Appendix 2. (Note changes in scale.)*



**Figure 4b** Number of captured and recaptured Chuditch in six (BG07-BG12) of the 12 sites surveyed five times within the BGM during 2001-2. Capture/recapture data for individual animals are shown in Appendix 2. (Note changes in scale.)



*Plate 14 Chuditch and Feral Cat footprints in silt at site BG08.*



*Plate 15 Chuditch pouch joeys.*





### 3.1.4 Native Mammal Breeding

Four native mammal species were recorded with pouch young during this study. They were Chuditch, Common Wambenger, Common Brushtail Possum and Southern Brown Bandicoot (Table 6).

**Table 6** Breeding data for four species of native mammal captured during the 2001-2 survey of the BGM study area.

| Tri<br>p<br>No. | Site<br>Code | Species                  | Ear<br>Tag # | Mammal Breeding data                                     |
|-----------------|--------------|--------------------------|--------------|--|
| 3               | BG01         | Chuditch                 | L96          | 5 pouch young - 10mm.                                    |
| 3               | BG04         | Chuditch                 | L84          | 4 pouch young - 10mm.                                    |
| 3               | BG07         | Chuditch                 | L87          | 6 pouch young - 14mm.                                    |
| 3               | BG08         | Chuditch                 | L14          | 3 pouch young - 5mm.                                     |
| 4               | BG05         | Chuditch                 | L35          | 5 pouch young - 60mm, small white spots showing on skin. |
| 4               | BG11         | Chuditch                 | L28          | 5 pouch young - 30mm.                                    |
| 4               | BG12         | Chuditch                 | L24          | 5 pouch young - 35mm.                                    |
| 5               | BG03         | Chuditch                 | L37          | 6 pouch young - 15mm.                                    |
| 5               | BG10         | Chuditch                 | L22          | 4 pouch young - 20mm.                                    |
| 5               | BG09         | Common Brushtail Possum  | L40          | 1 pouch young - 40mm.                                    |
| 4               | BG04         | Common Wambenger         |              | 7 pouch young - not measured.                            |
| 5               | BG09         | Common Wambenger         |              | 8 pouch young - 20mm.                                    |
| 1               | BG07         | Southern Brown Bandicoot |              | 1 pouch young - not measured.                            |
| 3               | BG02         | Southern Brown Bandicoot |              | 2 pouch young - 40mm.                                    |
| 5               | BG02         | Southern Brown Bandicoot |              | 2 pouch young very small - not measured.                 |

## 3.2 Frogs

Because of the extremely dry autumn and winter experienced in 2001 and a similarly dry period in 2002, frogs were most affected by these conditions and any conclusions drawn in this report may be misleading. However, it can be seen in Appendix 1 that, seven frogs were identified to species level and one additional species remained unconfirmed (*Heleioporus* sp.). Frogs were recorded in eight of the 10 sites, being absent only in sites BG02 and BG04.

### 3.2.1 Species Richness

A maximum of five frog species were recorded in the low-lying Wandoo site BG05 and in site BG09, a Wandoo/swamp. Three species were recorded in site BG01, two in sites BG03 and BG07, and only a single species in sites BG06 and BG08. None were recorded in sites BG02 and BG04. Site BG09 (Pillow

Swamp) was the only site where the Slender Tree Frog *Litoria adelaidensis* was recorded. This species generally occurs in dense vegetation in permanent swamps or streams. Pillow Swamp dries out completely during summer; therefore, it is most likely that individuals of this species shelter in damp soil under logs in the adjacent Wandoo woodland during this dry season.

The lowest number of species was recorded in spring when a single species of frog, *Crinia pseudinsignifera*, was recorded in five sites and none in the remaining five sites. Following good winter rains, large numbers of sub-adult frogs of several species such as *Heleioporus* species, *Limnodynastes dorsalis* and *Neobatrachus pelobatoides*, may be recorded in most forest types as they radiate out from breeding areas into localities where they burrow and aestivate for the summer. None of these species were recorded in spring and only single individuals of *Heleioporus* and *Limnodynastes* were recorded in the following autumn and winter sampling sessions.

### 3.2.2 Abundance

Frogs were relatively abundant in the low lying Wandoo sites BG01 and BG05, and in site BG09 (Wandoo/swamp) during the winter 2002 sampling period. Only *Crinia pseudinsignifera* was abundant in the Wandoo sites but this species and *Crinia glauerti* were in relatively high numbers in site BG09.

### 3.3 Reptiles

Sixteen reptile species were recorded during this study (Appendix 1) consisting of one Gecko, two Legless Lizards, one Dragon, nine Skinks, one Monitor, one Blind Snake and one Elapid (venomous) Snake. Snakes were under-represented in the results of this study.

Only one species of Skink, *Lerista distinguenda*, was captured in every site. Two Skinks *Hemiergis i. initialis* and *Menetia greyii* were captured in eight of the 10 sites. Ten of the 16 species were captured in less than half of the sampling sites, with four being recorded only from a single site.



*Plate 16 Gould's Whip Snake (Parasuta gouldii) captured at opportunistic site OP07.*

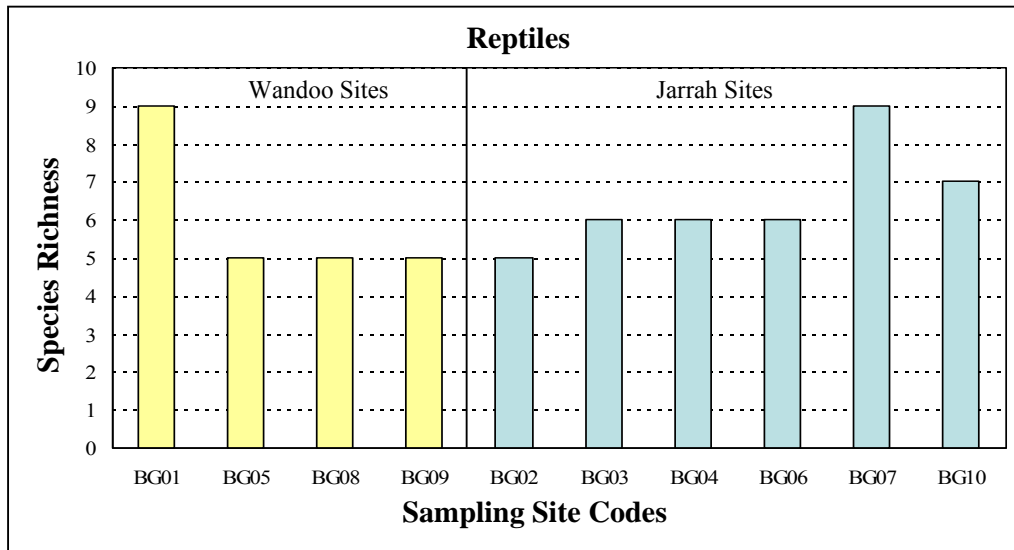
### **3.3.1 Species Richness**

It can be seen from Figure 6 and Appendix 1 that sites BG01 and BG07 had the highest species richness of reptiles with nine species each. Site BG10 had seven species and the remaining seven sites had between six and five species. There does not appear to be any correlation between species richness and habitat type or position in the landscape. For example, the two sites with the highest species richness were the low-lying Wandoo site BG01 and the upper slope Jarrah site BG07.

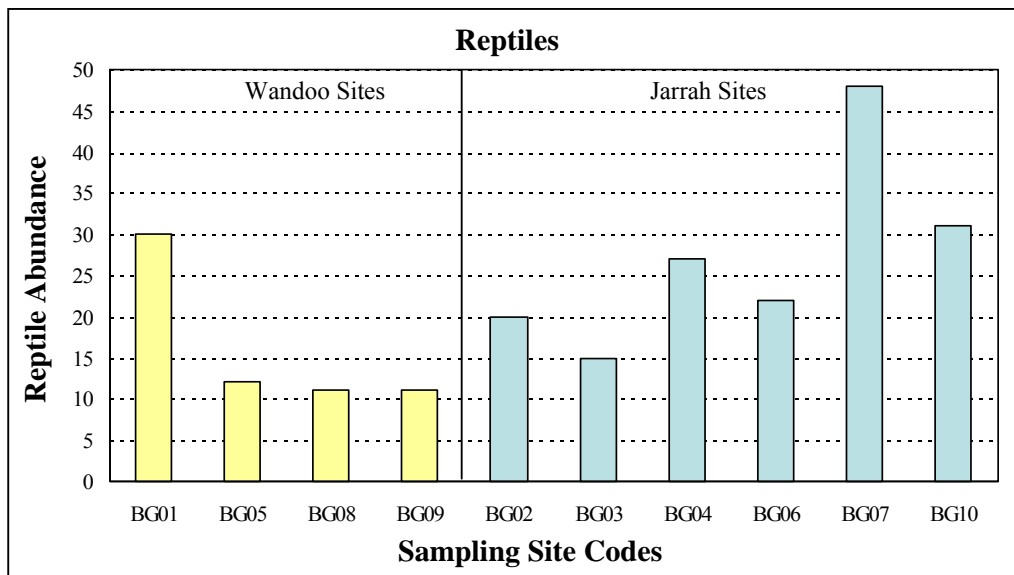
### **3.3.2 Abundance**

The upper-slope Jarrah site BG07 had by far the highest abundance of reptiles with 48 individuals (Figure 7). The small Skink *Menetia greyii* accounted for 29% of this total. This animal was also found in relatively large numbers in the Jarrah/Sheoak site BG06 where it accounted for 73% of the total number of individual reptiles (Appendix 1). This small Skink also accounted for 39% of the reptiles in the Jarrah/Sheoak site BG10. While the number of species was low in site BG04, this site had a relatively high abundance of individuals (27). The small Skink *Lerista distinguenda* made up 44% of this total.





**Figure 6** Reptile species richness recorded systematically in all three seasons in the 10 sampling sites within the BGM study area during 2001-2.



**Figure 7** Number of reptiles recorded systematically in all three seasons in the 10 sampling sites within the BGM study area during 2001-2.

Three Wandoo sites (BG05, BG09 and BG08) had the lowest abundance of reptiles with 12, 11 and 6 individuals respectively. These results may have occurred for various reasons, for example, all of these sites are low-lying and prone to water-logging. This may deter several of the burrowing species from inhabiting these sites. In addition, site BG05 and BG09 had extremely large numbers of the aggressive meat ant which may also predate on small reptiles or compete with them for food. The soil characteristics of site BG08 have changed since the 1984 baseline study through the deposition of clay/silt over the rocky gravel soil from nearby sumps draining from the mining area. This may have resulted in conditions becoming less favourable for burrowing animals such as small reptiles.

### **3.4 Birds**

The results of systematic and opportunistic bird sampling within the BGM are given in Appendix 4. Eighty-one species of native bird, comprised of 40 Non-passerines and 41 Passerines, were recorded in the BGM study area. Included in the list are three rare, threatened or vulnerable birds and one covered by an international treaty. These four species are discussed in detail in Section 5.2.

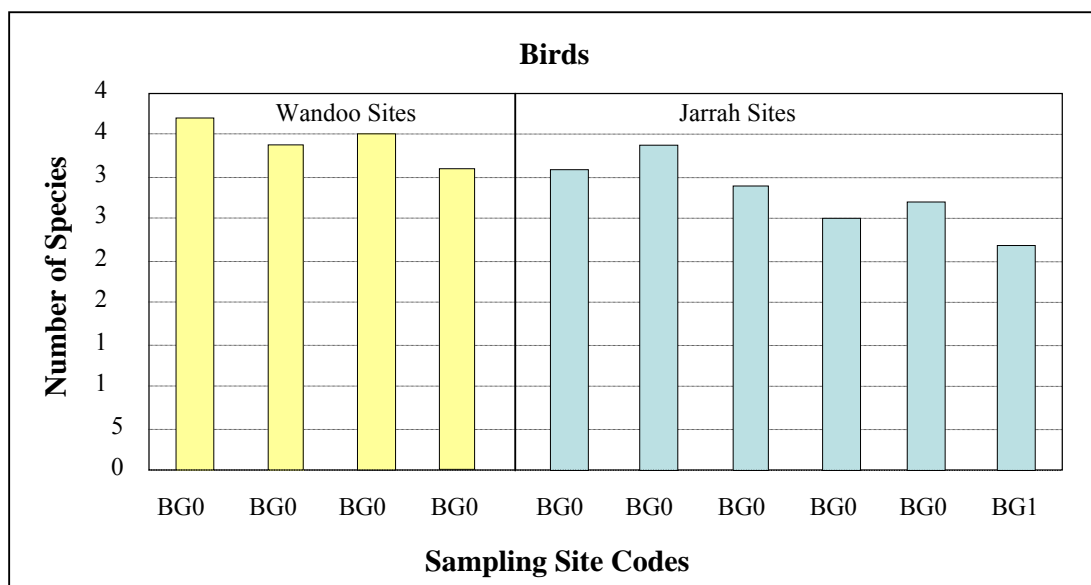
Of the total number of species recorded in the study area, 18 were recorded only in opportunistic sites, mainly the freshwater lakes D1 and D4. This included 11 species of waterbird, two birds of prey, one heron, one spoonbill and one shorebird. The 63 species recorded in the 10 sites (BG01 to BG10) during systematic sampling have been used in the following sections.

The Western Spinebill was the only bird to be recorded in every site in every seasonal sampling period. The Grey Fantail was recorded from every site and was only absent from sites BG03 and BG04 in spring 2001. Several small insectivores were observed in all sites but were absent in different seasons. For example, the Broad-tailed Thornbill was absent in spring from site BG01 and BG05 and from site BG06 in autumn. The Western Thornbill was absent in spring from sites BG01 and BG05 and was also absent in site BG01 in autumn. This probably reflects localized movements of these birds.

#### **3.4.1 Species Richness**

Figure 8 shows that the richest sites for birds over all seasons were Wandoo woodland sites BG01, BG05 and the Wandoo/heath site BG08 with 42, 39 and 40 species respectively. One Jarrah/Banksia site, BG03, was similar to the Wandoo sites with 39 species. The Wandoo/swamp site BG09 had 36 species

and four of the remaining five sites ranged between 36 and 30 species. Only 27 species were recorded in the Jarrah/Sheoak site BG10.

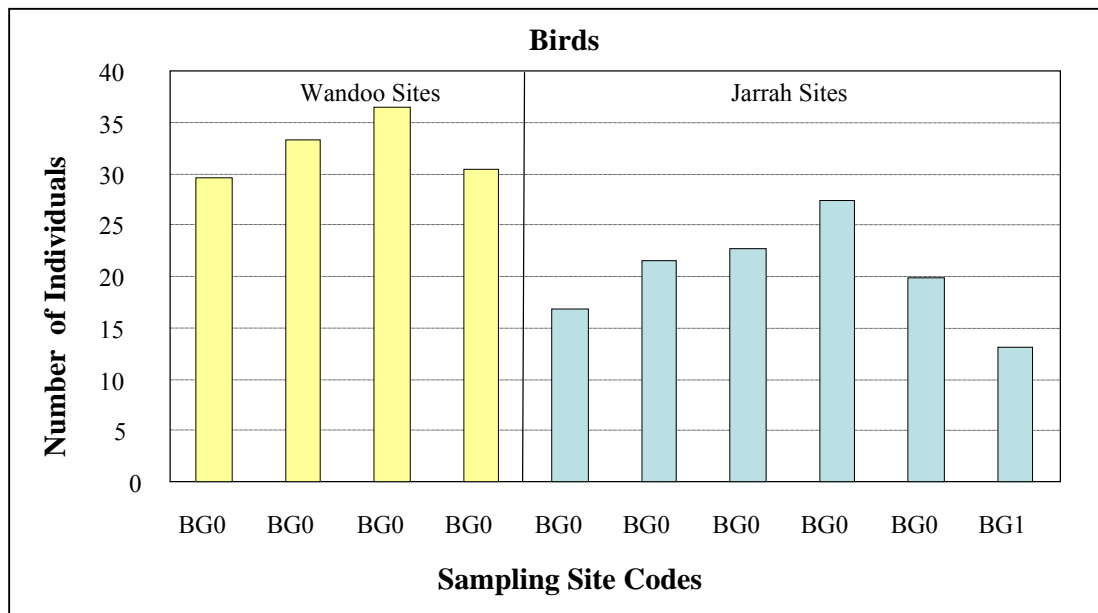


**Figure 8** Bird species richness recorded systematically in all three seasons in the 10 sampling sites within the BGM study area during 2001-2.

### 3.4.2 Abundance

As discussed in Section 2.3, the daily data from each site in each of the three surveys was scanned to ascertain the specific day when the highest number of individuals for each species in each site was recorded. The total for this day was selected as being a reliable index of site by site relative abundance. For the abundance discussed in this section, the three seasonal results were added together to take into account the occasionally large discrepancies in abundance between seasons. These seasonal numbers are discussed in Section 3.4.3.

Appendix 4 and Figure 9 show, using highest daily count as discussed in Methods, that all sites that included Wandoo as the main component of the upper vegetation stratum had the highest abundance of individuals over the three sampling seasons. The Wandoo/heath site BG08 had the highest abundance with 364 individuals. This large number was made up of New Holland Honeyeaters (40 birds), Brown Honeyeaters (50 birds) and relatively high numbers of the Splendid Fairy-wren, Striated Pardalote, White-browed Scrubwren and Western Spinebill. This was followed by site BG05 with 332 birds, which included large numbers of the Striated Pardalote, Brown Honeyeater and Weebill. Sites BG01 and BG09 had 296 and 304 birds respectively.



**Figure 9** Number of birds recorded systematically in all three seasons in the 10 sampling sites within the BGM study area during 2001-2.

The highest number of birds in the Jarrah sites was 274 in the Jarrah/ Sheoak site BG06. This number of birds was attained mainly through a large influx of White-naped Honeyeaters (50 birds) and New Holland Honeyeaters (60 birds) during autumn and winter when *Dryandra sessilis* was flowering heavily at this site.

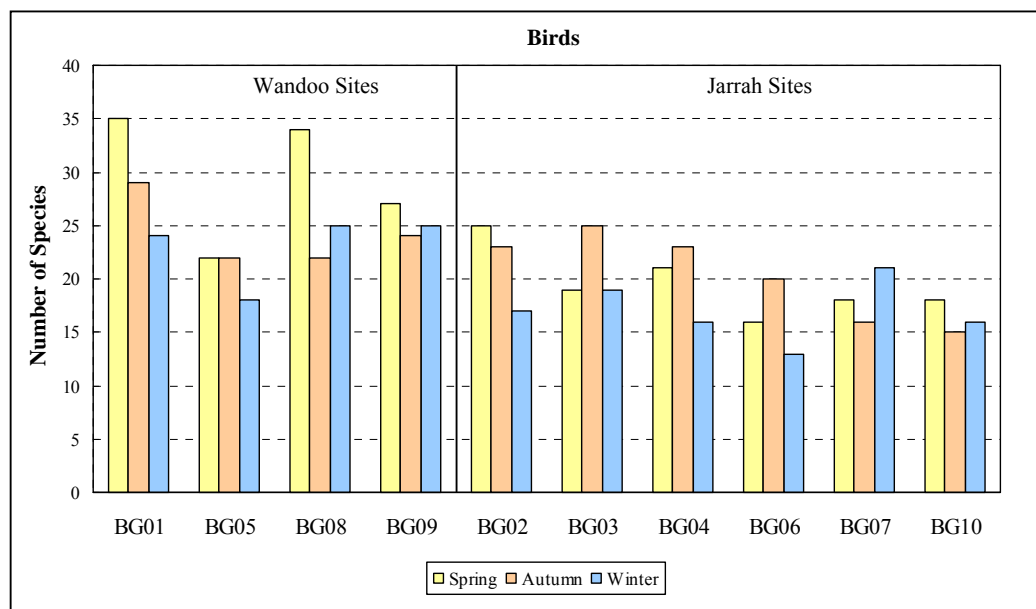
Within these abundance figures were some relatively large flocks of certain Non-passerine birds. For example, a flock of 50 Red-tailed Black-Cockatoos were observed in site BG03 in autumn 2002. During spring 2001, thirty-five Carnaby's Cockatoos were seen in BG05 and 30 were seen in site BG07.

### 3.4.3 Seasonality

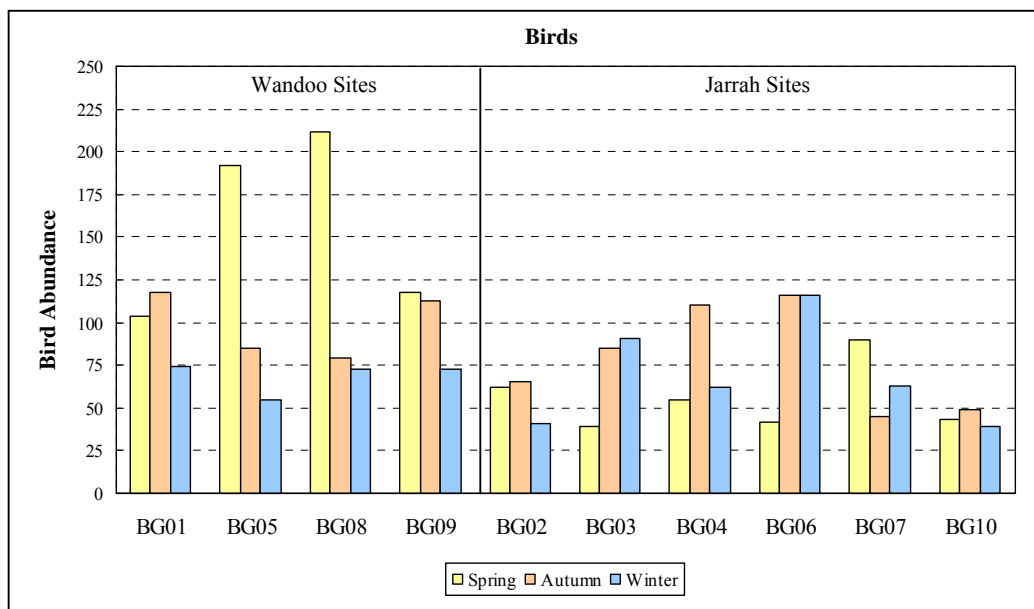
Appendix 4 shows that seasonal migrants such as the Horsfield's Bronze-Cuckoo, Shining Bronze-Cuckoo, Sacred Kingfisher and Rainbow Bee-eater were in extremely low numbers, particularly the latter two birds. Spotted Pardalotes were also in very low numbers. Brown Honeyeaters were recorded in every site in spring and were particularly abundant in Wandoo sites BG05 and BG08 in that season. However, they were only present in one site in autumn (BG01) and one site (BG06) in winter and were represented by only one and three individuals respectively.

Figure 10 shows the total species richness (Non-passerine and Passerine) in each sampling site on a seasonal basis. The high species richness generally expected during spring was particularly evident only in the Wandoo sites BG01 and BG08. Four sites (BG05, BG09, BG02 and BG10) had only marginally higher or equal species richness in spring when compared to autumn and winter and four sites (BG03, BG04, BG06 and BG07) had their lowest species richness in spring.

Figure 11 and Appendix 4 show the seasonal index of bird abundance in the 10 sampling sites. The two Wandoo sites BG05 and BG08 showed a wide disparity between bird abundance in spring and the two later seasons. These two sites supported extremely large numbers of Brown Honeyeaters in spring (80 and 50 birds respectively). This species was absent from most sites, including BG05 and BG08, during autumn and winter. Only one bird was recorded in site BG01 in autumn and three birds were recorded in site BG06 in winter. This species is nomadic in the Jarrah forest region and may occur in large numbers wherever dense flowering of shrubs or trees occurs. Large numbers of New Holland Honeyeaters also occurred in site BG08 in spring but were much less abundant in autumn and winter in this site. The relatively high numbers of birds in site BG06 in autumn and winter were also made up of New Holland Honeyeaters. The peak of bird numbers in site BG04 in autumn was made up of Tree Martins which had congregated at this site at this time.



**Figure 10** Bird species richness recorded systematically in three separate seasons in the 10 sampling sites within the BGM study area during 2001-2.



**Figure 11** Bird abundance recorded systematically in three separate seasons in the 10 sampling sites within the BGM study area. (Maximum daily count for every species in each site in each season has been used in this diagram.)

### 3.4.4 Bird Breeding

Every site was intensively searched for bird breeding activity, particularly during spring 2001. The resulting data is shown in Table 7. Sixteen species were recorded with breeding data, and breeding information was recorded in all sites except BG03 and BG04.

**Table 7** Breeding data for bird species observed during the 2001-2 survey of the BGM study area.

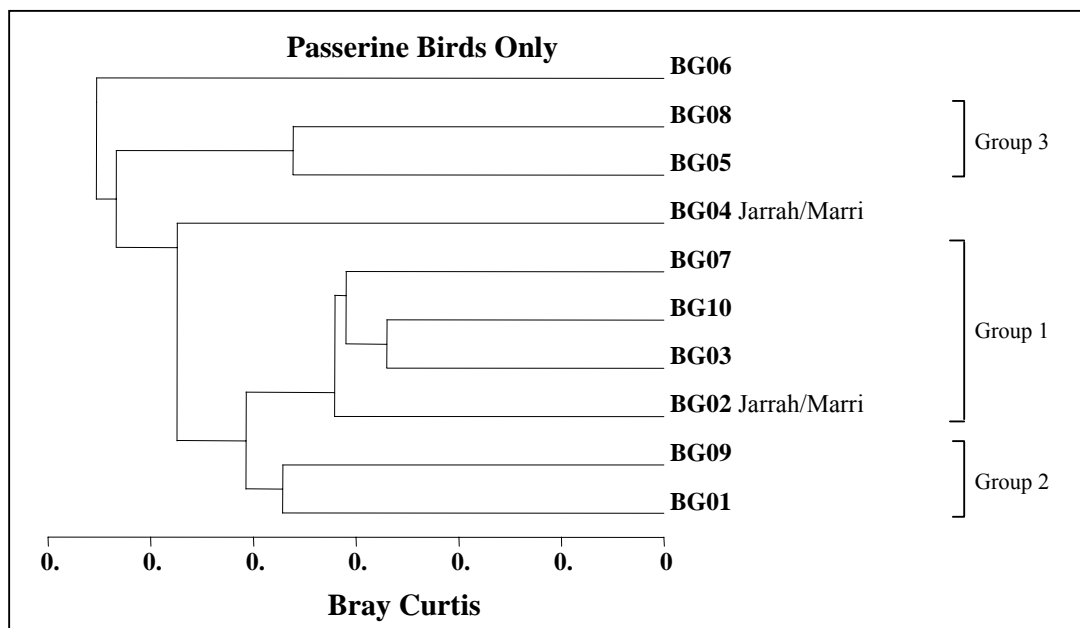
| Trip No. | Site Code | Species                 | Nesting Data  |
|----------|-----------|-------------------------|---|
| 1        | BG01      | Splendid Fairy-wren     | Two eggs in nest 1m/1.2m <i>Acacia celastrifolia</i> .                  |
| 1        | BG01      | Splendid Fairy-wren     | Three fledglings being fed by adults.                                   |
| 2        | BG01      | Australian Magpie       | Old nest 10m/12m <i>Eucalyptus marginata</i> .                          |
| 2        | BG02      | Grey-breasted White-eye | Old nest 3m/4m <i>Persoonia longifolia</i> .                            |
| 1        | BG05      | White-winged Triller    | Feeding dependent young.  |
| 1        | BG05      | White-winged Triller    | Two fledglings in nest 5m/10m <i>Eucalyptus wandoo</i> .                |
| 1        | BG05      | Dusky Woodswallow       | One fledgling fallen out of nest. Still being fed by both parent birds. |
| 1        | BG05      | Dusky Woodswallow       | Three fledglings in nest 12m/15m burnt dead tree.                       |
| 1        | BG05      | Striated Pardalote      | Nest in hollow limb 8m/15m <i>Eucalyptus wandoo</i> .                   |
| 1        | BG06      | Broad-tailed Thornbill  | Nest on ground - three dead fledglings found                            |

| Trip No. | Site Code | Species                 | Nesting Data   |
|----------|-----------|-------------------------|--|
|          |           |                         | inside   |
| 1        | BG06      | Grey Currawong          | Nest 6m/8m <i>Eucalyptus marginata</i> .                                       |
| 2        | BG06      | New Holland Honeyeater  | Old nest 2.5m/3m <i>Dryandra sessilis</i> .                                    |
| 1        | BG07      | Brown Goshawk           | Nest 11m/13m <i>Eucalyptus marginata</i> .                                     |
| 1        | BG08      | Striated Pardalote      | Nest 6m/9m <i>Eucalyptus wandoo</i> in hollows (2 nests in opposite branches). |
| 1        | BG09      | Brown Honeyeater        | Nest 0.5m/2.5m dead <i>Hakea prostrata</i> .                                   |
| 1        | BG09      | New Holland Honeyeater  | Nest 4m/5m <i>Corymbia calophylla</i> .  |
| 3        | BG09      | White-breasted Robin    | Nest 50cm/1m dead <i>Acacia</i> .  |
| 1        | BG09      | Yellow-rumped Thornbill | Nest 1.5m/4m <i>Hakea prostrata</i> .  |
| 1        | BG10      | Australian Raven        | Old nest 12m/15m <i>Eucalyptus marginata</i> .                                 |

### 3.4.5 Bird Community Analysis

The following discussion and diagram (Figure 12) have been based on all bird data collected during the three seasons sampled in this study. The choice of the Bray Curtis coefficient is based on the assumption that the same difference for either abundant or rare species contributes equally to the similarity between sites. This measure also offers the ability to act as a metric measure where the numbers of specimens are the same in all sites (Legendre and Legendre 1998).

Passerine birds have been selected for this analysis because they are generally more habitat specific and less likely to appear as large, highly mobile flocks than Non-passerine birds. Large flocks of birds that appear sporadically generally distort the data so that sites appear more distinct than they may be in reality. While this effect happens frequently with Non-passerine birds, it occurs less frequently with Passerines. However, birds such as Tree martins can have a similar effect.



**Figure 12** A dendrogram showing the systematic site groupings for the BGM study area during 2001-2 based on Passerine bird species richness and abundance.

It can be seen from Figure 12 that there is one major grouping of four Jarrah/Marri sites (BG07, BG10, BG03 and BG02 – Group 1). These sites group together because they have a very similar suite of Passerine bird fauna. Although the Wandoo/Swamp sites (BG01 and BG09 – Group 2) group together, they do not form a close relationship with the remaining Wandoo sites (BG05 and BG08 – Group 3). The dense understorey associated with swamp habitat has almost certainly affected the Passerine bird fauna of sites BG01 and BG09, causing a separation of these two small groups of sites.

Two sites stand out as being quite distinct, the Jarrah/Marri/Sheoak site BG06 and the Jarrah/Marri site BG04. Site BG06 was unusual in that it was relatively isolated by major haul roads and recently rehabilitated areas. This site also had extensive thickets of *Dryandra sessilis* which attracted large numbers of honeyeater birds while flowering in autumn and winter. Site BG04 was also unusual in that it had very little understorey above 0.5m. This site had a large flock of Tree Martins (50 birds) which were relatively uncommon in all other sites. However, it lacked the large numbers of Brown Honeyeaters that were a feature of many of the other sites.



### **3.5 Introduced Species**

Five introduced mammals were recorded during this study (Appendix 1). Pigs appeared to be the most common feral animal, with several groups seen during both systematic sampling and opportunistically along tracks between sites. All other introduced species were uncommon, for example, only a single House Mouse (*Mus musculus*), and one Feral Cat (*Felis catus*) were captured during the whole study.

No introduced mammals were recorded in two sites, BG06 and BG07.

### **3.6 Opportunistic Sampling**

As the majority of the animals recorded within opportunistic sites were also recorded within systematic sites, this section concentrates on species that were not recorded during systematic sampling. It can be seen from Appendix 4 that the results from opportunistic sampling only were generally birds associated with water. The majority of these species were recorded during regular inspections of the D4 Freshwater Lake. The exception was the White-necked Heron that was observed in Pillow Swamp (BG09).

During the observation period conducted on D1 lake, no waterbirds were seen. However, this lake was only visited once whereas D4 was sampled every day in each field survey en route to BG05. As a result, fourteen waterbirds were recorded using this lake. Some large aggregations of Hoary-headed Grebe (70 birds) and Eurasian Coots (66 birds) were also observed regularly on D4 lake as were Australian Shelduck (26 birds) and Musk Duck (23 birds). Two birds of prey, the Peregrine Falcon and Swamp Harrier, were also recorded. Both of these birds feed on waterfowl.

## **4 COMPARISONS WITH 1984**

Extensive changes to sampling procedures have taken place since 1984, and several original sites no longer exist, therefore only presence/absence data have been used in the following comparisons.

In 1984, the Freshwater Lakes had not yet been constructed. However, an assessment of waterbird use of these lakes took place in 1991 and 1992 and these results have been used (Worsley Alumina Pty Ltd 1999). The results from 1984, 1991, 1992 and 2001-2002 are presented in Appendix 5.

## 4.1 Native Mammals

Twelve native mammals, including three species of bat, were recorded in 1984. Eight were recorded in 2001-2, with two of these being new for the study area (Appendix 5). Therefore a total of 14 species are known to occur in the BGM.

While there is an apparent absence of dunnarts and pygmy-possums during 2001-2, the major change appears to be a large increase in population of larger, carnivorous marsupials such as the Common Wambenger and Chuditch. When analysed on an 'animals per 100 trapnights' basis, Common Wambengers have increased from a capture rate of 0.23 to 0.56 animals per 100 trapnights. However, the increase in population of Chuditch from 0.46 to 2.28 animals per 100 trapnights overshadows all other data. The presence of such a large population of Chuditch may have had an adverse impact on small mammal numbers.

In addition, animals such as the Southern Brown Bandicoot have gone from zero in 1984 to a population of 0.94 animals per 100 trapnights. The Common Brushtail Possum has also gone from zero to 0.17 animals per 100 trapnights.

## 4.2 Frogs

While one species of frog (*Crinia glauerti*) was added to the BGM study area, six, mainly burrowing species, that were recorded during 1984 were absent during this current study. In part, this could be due to the preceding two dry winters having an effect on frog populations by limiting successful breeding. However, some swamps within the study area have been dramatically impacted through clearing for haul roads and others may have been indirectly affected by changes to drainage patterns by road construction and maintenance. The main riparian system through the BGM, 34 Mile Brook, has been highly modified in sections as a result of damming for water supply. In addition, this stream passes through Wandoo woodlands that have been affected by the fungus *Armillaria*. The effect of this fungus on vertebrate and invertebrate animals and aquatic ecological processes through loss of canopy cover or other, unknown, factors, is unknown. Only sampling following average or above average autumn rainfall will clarify this issue.

## 4.3 Reptiles

A total of 20 species of reptile were recorded in 1984 compared with 16 during 2001-2. However, two species were added to the inventory for the BGM study area: the legless lizard *Aprasia pulchella* and the Dugite (*Pseudonaja a. affinis*).

These two species bring the total known from BGM to 22. The most obvious difference was in the geckos, where three of the four species recorded during 1984 were absent during this current study. This may have been a result of the difficulties of nocturnal sampling complying with the strict security arrangements in place during 2001-2.

While some reptiles such as Dell's Skink (*Ctenotus delli*) were known from only one site in 1984, and also in 2001-2, albeit a different site, other such as the small skink *Lerista distinguenda* were captured in very small numbers in only three sites in 1984, were captured in every site in 2001-2, occasionally in relatively high numbers (12 individuals in site BG04). The Common Dwarf Skink (*Menetia greyii*) was also much more common and widespread in 2001-2 than in 1984.

#### **4.4 Birds**

A total of 77 birds were recorded during 1984 and the subsequent sampling of waterbirds in 1991-2. This compares with 81 species recorded during this current study. While a substantial number of these birds are common to both studies, there is a range of birds that are unique to each sampling period. Ten species are unique to 1984 and 1991-2 and 14 are unique to 2001-2. This has resulted in a total of 91 birds known to occur at various times in the BGM study area.

While the Hardhead and Common Sandpiper that were recorded during 1991 and 1992 were not recorded during this survey, the Hoary-headed Grebe, Great Cormorant and Yellow-billed Spoonbill were additions to the species inventory for these lakes. The higher number of waterbirds recorded during this current study may be a result of maturing of the D4 Freshwater Lake and the subsequent feeding resources that are now available. The preceding dry winters could also have resulted in a concentrating effect in areas wherever water was retained.

The honeyeater group also showed substantial differences with the addition of the White-eared, Brown-headed and Tawny-crowned Honeyeater and the absence of Yellow-plumed and White-cheeked Honeyeater. This group of birds is highly nomadic, responding to flowering events over a widespread area. In general, they are more common in the woodlands and heaths of the more arid country to the east of the Jarrah forest. This is also true of the Jacky Winter, recorded during 2001-2.

The vagaries of sampling or inherent scarcity of particular species are likely to account for many of the other birds that were recorded only in 1984 or 2001-2,

for example, five birds of prey, the Boobook Owl, Mistletoebird and Red-eared Firetail were unique to one of these sampling periods.

#### **4.5 Introduced Species**

Four introduced species were recorded in 1984. These were all recorded during 2001-2 with the addition of the Rabbit and Feral Cat to the area inventory (Appendix 5).

### **5 RARE, THREATENED OR VULNERABLE FAUNA**

#### **5.1 Definition of Rare, Threatened or Vulnerable Fauna**

Prior to any discussion of rare, threatened, vulnerable or otherwise significant fauna, a definition of terms may be required. While this has been done in previous reports to Worsley Alumina, recent changes, particularly with regard to Commonwealth legislation makes it necessary to reiterate these definitions. Therefore, the following describes the various State and Commonwealth Acts that cover these species.

This section is correct at the time of this document. However, as changes are made to both State and Commonwealth legislation and new international treaties are entered into, all current documentation regarding rare, threatened and vulnerable fauna should be periodically reviewed for any assessment of the status of fauna in a given area.

##### ***5.1.1 Protected Species - Western Australia***

Currently in Western Australia, rare or endangered species are protected by the Wildlife Conservation Act (1950) specifically, the *Wildlife Conservation (Specially Protected Fauna) Notice 2000*. The two schedules relevant to this study and defined under this notice are:

- Declared Threatened Fauna - Schedule 1- fauna that is ranked as presumed extinct, critically endangered, endangered or vulnerable;
- Other Specially Protected Fauna - Schedule 4.

The list of protected fauna is periodically reviewed and the current list was published in the Government Gazette, WA (2000) as the *Wildlife Conservation (Specially Protected Fauna) Notice 2000*.

### **5.1.2 Priority Species - Western Australia**

A 1997 review of the International Union for Conservation of Nature and Natural Resources (IUCN) criteria for threatened species resulted in the deletion of several species from Western Australia's *Wildlife Conservation (Specially Protected Fauna) Notice 2000*. Some of these species have been placed on the Department of Conservation and Land Management (CALM) Priority Fauna List and require further monitoring.

Priority Fauna List classifies species as:

- Priority 1 - taxa with few, poorly known populations on threatened lands;
- Priority 2 - taxa with few, poorly known populations on conservation lands;
- Priority 3 - taxa with several, poorly known populations, some on conservation lands;
- Priority 4 - taxa in need of monitoring.

The Priority Fauna List does not confer any additional legal protection to the species listed apart from the normal protection afforded to most native animals. It does, however, indicate the need for vigilance during construction and commissioning of development projects to manage native vegetation and rehabilitation so that Priority species, should they occur, do not meet the IUCN Criteria for listing on the Threatened Species List.

### **5.1.3 Protected Species - Commonwealth**

In 1974, Australia signed the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). As a result, an official list of endangered, vulnerable or presumed extinct species was constructed (Schedule 1) and is regularly updated (*Endangered Species Protection Act 1992*). However, in July 2000 this Act was replaced by the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC), which retained the schedule of endangered and threatened species of the act it replaced.

The vertebrate fauna listed on the current schedule differs from the two State lists, although there are some species that appear on both, for example, the Chuditch and Long-billed Black-Cockatoo. There are three parts to Schedule 1:

- Part 1 - species that are endangered;
- Part 2 - species that are vulnerable;
- Part 3 - species that are presumed extinct.

#### **5.1.4 International Agreements**

The international agreements: Japan-Australia (JAMBA) and China-Australia (CAMBA) Migratory Bird Agreements, differ from Schedule 3 of the State *Wildlife Conservation (Specially Protected Fauna) Notice 1998*. Most of the species listed on the JAMBA and/or CAMBA agreements are associated with coastal shores or inland saline wetlands although some birds that are not associated with water are also listed on these international treaties.

## **5.2 Presence of Rare, Threatened or Vulnerable Fauna**

In any discussion of rare, threatened or vulnerable species, several aspects require clarification before the significance of these species can be considered in context.

- Rare fauna are an understandably sensitive issue, and there is a tendency to view all such high-profile species as being of equal importance. In reality this is not the case. The most important factor to take into account is whether a rare species is resident or not. Resident, habitat-specific fauna, are self-evidently much more susceptible to the influences of disturbance than nomadic or migratory species.
- Not all rare species are equally susceptible to disturbance. Many are widely distributed animals, passage migrants, nomads, vagrants or naturally uncommon predators at the higher trophic levels of the food chain. Some rare species such as the Peregrine Falcon can accommodate the high levels of disturbance present in urban and suburban environments, while others persist in the face of lower-level disturbance such as partially cleared land, as long as mature trees with hollows suitable for breeding and patches of dense remnant vegetation remain. Examples are the Quenda, Carpet Python and the various species of Black-Cockatoos.
- The concept of individual species rarity is a dynamic process considerably influenced by the level of survey work carried out in a particular location. An improved understanding of distribution patterns over time can lead to modifications in the perceived status of a rare animal such that it can subsequently be judged to be more common or,

alternatively, rarer than originally thought. For Example, in 1997 the Southern Brown Bandicoot or Quenda (*Isoodon obesulus fusciventer*) was listed as a rare Schedule 1 species. By early 1998 it had been transferred to the CALM Priority Fauna List. In the July 2000 list, it has changed to a Conservation Dependent status. Listing of species, in many cases, tends to act as a temporary, albeit essential, safeguard until a better understanding of populations, distribution and biology is obtained.

Table 8 discusses the rare, threatened or vulnerable species which were recorded during the fauna studies of the BGM study area in both 1984 and 2001-2.

**Table 8** List of rare, threatened or vulnerable species recorded in the BGM study area during 1984 and/or 2001-2.

| <b>MAMMALS</b>      |   |
|---------------------|---|
| <b>Species</b>      | <b>Chuditch - <i>Dasyurus geoffroi</i></b>  |
| <b>Status</b>       | Schedule 1 Part 2 - Commonwealth Endangered Species Act;<br>Schedule 1 - State Wildlife Conservation Act.   |
| <b>Distribution</b> | Once widespread throughout the southern portion of Australia, now restricted mainly to the south-west of Western Australia.   |
| <b>Habitat</b>      | Most forest and woodland types.   |
| <b>Occurrence</b>   | Recorded in two sites in 1984 but in all 10 sites in greatly increased numbers during 2001-2.   |
| <b>Species</b>      | <b>Common Wambenger (Brush-tailed Phascogale) - <i>Phascogale tapoatafa</i></b>   |
| <b>Status</b>       | Priority 3 - CALM Priority List   |
| <b>Distribution</b> | South-West forests.   |
| <b>Habitat</b>      | Most forest types in the South-West   |
| <b>Occurrence</b>   | Only recorded in one site in 1984 but captured in four sites in this current survey.  |
| <b>Species</b>      | <b>Southern Brown Bandicoot (Quenda) - <i>Isoodon obesulus fusciventer</i></b>  |
| <b>Status</b>       | Priority 4 (Conservation Dependent) - CALM Priority List  |
| <b>Distribution</b> | South-West coastal plains and forests.  |
| <b>Habitat</b>      | Although this animal can be found in many different vegetation types in the South-West it is most common in swamps and riparian vegetation.                             |
| <b>Occurrence</b>   | Not recorded in 1984, this animal was captured in five of the 10 sites in 2001-2. Six individuals were captured in the Wandoo woodland surrounding Pillow Swamp (BG09). |

|                     |   |
|---------------------|---|
| <b>Species</b>      | <b>Western Brush Wallaby - <i>Macropus irma</i></b>   |
| <b>Status</b>       | Priority 4 - CALM Priority List   |
| <b>Distribution</b> | South-West forest region.   |
| <b>Habitat</b>      | Mainly Jarrah/Marri forest with a dense understorey   |
| <b>Occurrence</b>   | Observed in four of the eight sites in 1984 and in three of the 10 sites during 2001-2.   |
| <b>BIRDS</b>        |   |
| <b>Species</b>      | <b>Peregrine Falcon - <i>Falco peregrinus</i></b>   |
| <b>Status</b>       | Schedule 4 - State Wildlife Conservation Act.   |
| <b>Distribution</b> | Throughout Australia.   |
| <b>Habitat</b>      | Most habitat types with a preference for tree-lined watercourses.   |
| <b>Occurrence</b>   | Not recorded in 1984 but observed during this current survey perching and flying in the vicinity of D4 Freshwater Lake where it probably preys on waterfowl.  |
| <b>Species</b>      | <b>Forest Red-tailed Black-Cockatoo – <i>Calyptorhynchus banksii naso</i></b>   |
| <b>Status</b>       | Priority 3 – CALM Priority List   |
| <b>Distribution</b> | South-West region.  |
| <b>Habitat</b>      | Forests.  |
| <b>Occurrence</b>   | Recorded infrequently in 1984 (two sites only) but observed in eight of the 10 sites during 2001-2. The largest flock observed during systematic sampling was 50 birds in site BG03 during the winter survey. The loss of breeding hollows through the destruction of forests is thought to be the major cause of decline of this species (Johnstone & Storr 1998). Recent work by R.E. Johnstone has shown that feral honey bees have been displacing various species of cockatoo from breeding hollows. In his study area near Wungong, up to 21% of nesting hollows have been abandoned by cockatoos for this reason (R.E. Johnstone pers. comm.). Both the Water Corporation and Serpentine – Jarrahdale Shire Council are funding research into this aspect of cockatoo decline in the South-West. |
| <b>Species</b>      | <b>Baudin's Black-Cockatoo – <i>Calyptorhynchus baudinii</i></b>  |
| <b>Status</b>       | Schedule 1 Part 2 – Commonwealth Endangered Species Act;<br>Schedule 1 – State Wildlife Conservation Act.   |
| <b>Distribution</b> | South-West region   |
| <b>Habitat</b>      | Generally more common in the tall forests of the deep South-West, this species occurs further north when not breeding.  |
| <b>Occurrence</b>   | Recorded in four of the eight sites in 1984 but not recorded during 2001-2<br>All of the comments made above for the Red-tailed Black-Cockatoo are also relevant to this species.   |
| <b>Species</b>      | <b>Carnaby's Black-Cockatoo – <i>Calyptorhynchus latirostris</i></b>  |
| <b>Status</b>       | Schedule 1 Part 1 – Commonwealth Endangered Species Act;<br>Schedule 1 – State Wildlife Conservation Act.   |
| <b>Distribution</b> | Mid-west, Wheatbelt and much of the South-West region.  |
| <b>Habitat</b>      | Most forest and woodland habitats, pine plantations and heaths, may occasionally feed in cleared paddocks.  |



|                     |  |
|---------------------|--|
| <b>Occurrence</b>   | A single flock of 12 recorded in 1984, this species was more common in this current study. Recorded in five of the 10 sites with large flocks of 30 or more birds being observed in sites BG05 and BG07. All of the comments made above for the Red-tailed Black-Cockatoo are also relevant to this species. |
| <b>Species</b>      | <b>Rainbow Bee-eater – <i>Merops ornatus</i></b>   |
| <b>Status</b>       | Japan/Australia Migratory Bird Agreement (JAMBA)   |
| <b>Distribution</b> | Most of WA except desert regions.  |
| <b>Habitat</b>      | Mainly aerial, this bird feeds on insects over most habitats including cleared land. This bird arrives in the South-West from the northern hemisphere in September, returning north in autumn. It breeds in the South-West where it burrows into sandy banks to create a nesting chamber.                    |
| <b>Occurrence</b>   | Recorded in three sites in 1984 and three sites in 2001-2.   |
| <b>REPTILES</b>     |  |
| <b>Species</b>      | <b>Dell's Skink – <i>Ctenotus delli</i></b>  |
| <b>Status</b>       | Priority 4 – CALM Priority List  |
| <b>Distribution</b> | Very restricted distribution in the Darling Range.   |
| <b>Habitat</b>      | Prefers areas of dense shrubland as an understorey to Jarrah/Marri forest. Occasionally found in association with granite outcrops.  |
| <b>Occurrence</b>   | Recorded in 1984 in site B501H (now BG08) and in site BG07 in this current study. Extremely uncommon, only a single specimen captured in each of the studies.  |
| <b>Species</b>      | <b>Carpet Python - <i>Morelia spilota imbricata</i></b>  |
| <b>Status</b>       | Schedule 4 - State Wildlife Conservation Act.  |
| <b>Distribution</b> | Southern Western Australia including western portion of the Wheatbelt.   |
| <b>Habitat</b>      | Forests, woodlands, heath and granite outcrops.  |
| <b>Occurrence</b>   | Recorded opportunistically in 1984 when one animal was observed crossing a track. Not recorded during this current study.  |

## 6 REGIONAL AND LOCAL SIGNIFICANCE

### 6.1 Regional Significance

The Australian Nature Conservation Agency (1995) has established an Interim Biogeographical Regionalisation of Australia (IBRA). BGM lies within the JF - Jarrah Forest Region.

Most of the Jarrah forest had been subject to logging and a large proportion, particularly to the east, has been cleared for agriculture, mainly along valley floors which are free of laterite (Beard 1990). To the west, many valleys have been cleared and dammed for surface water storage for both domestic and agricultural use. These long-term impacts make the remaining forested areas, particularly valleys, of relatively high conservation significance.

## 6.2 Local Significance

BGM contain a large range of habitats from upland Jarrah forest with large amounts of surface rock, to valleys and swamps where Wandoo dominates the upper vegetation strata levels. The area is connected to State forest, forming a continuum of a variety of forest ecosystems. However, large areas within the BGM have been disturbed by deep, open-cut mining, fresh water storage and tailings dams, haul roads and other infrastructure. In particular, the valley systems have sustained substantial impact, not only from mining and associated infrastructure, but from the spread of the fungus disease *Armillaria*.

In the Boddington area, there has been historical disturbance to large areas of eastern Jarrah forest from farming and logging, and more recently from bauxite and gold mining. However, there are no areas dedicated to conservation in the Boddington region. Relatively large areas of forest within the BGM have been disturbed for mining, water storage, tailings dams and construction of infrastructure. However, the results from this current survey show that the remaining forest retains much of the vertebrate fauna that was recorded during initial studies in 1984. Some species have been added to the area inventory and some that were present in 1984 were not represented in the results from this current study. Most, if not all, of these changes are more likely to be due to natural variations in animal populations and their food and shelter requirements, reflecting changes in weather patterns over many years.

## 6.3 Habitats of Significance

Defining a significant habitat is not open to an empirical approach where points are assigned to various factors and then totalled for comparative purposes. While elements such as species richness, the number of rare, threatened or vulnerable animals and several other similar factors can be used as significance indicators for some habitats, there are features which do not suit this type of analysis. Certain vegetation communities can have a low species richness, support little in the way of rare or specialised fauna, but still be of significance; for example, they may be essential in certain ecological processes. Fauna habitats that are not well-represented locally and/or regionally, or have environmental conditions that set them apart, can also be significant. This aspect can include wetland or creek habitats which are the exception rather than the rule in the low rainfall, eastern limits of the Darling Range. The swamps and streams of BGM fall into this category.

It is obvious from the results given in preceding sections of this document that areas of Wandoo woodland are highly significant to many species of animals, particularly birds. The trees provide a large number and variety of nesting and/or refuge hollows. When flowering, they are a rich source of nectar for honeyeaters and the leaves support a large biomass of invertebrates that provide a substantial food resource for leaf-gleaning birds.

The D4 Freshwater Lake has become an important local resource for relatively large numbers of waterfowl and a range of other birds dependent upon fresh water. This was particularly evident during this study which was conducted during an extended dry period in South-West Australia.

## **7 CONCLUSIONS AND RECOMMENDATIONS**

### **7.1 Conclusions**

The vertebrate fauna that was recorded during this study reflects the drier, eastern Jarrah forest. However, it is likely that the unusual weather conditions experienced during the study, with very little autumn or winter rainfall in the preceding years, have affected the results, particularly the frog fauna.

The population density of medium-sized native mammals such as the Chuditch, Brush-tailed Possum and Southern Brown Bandicoot have increased substantially from 1984 to 2001-2 but small mammals such as the Western Pygmy-possums and dunnarts were not present in this current study.

Four mammal, five bird and two reptile species listed as rare, threatened or vulnerable are known to occur within the habitats of the BGM. Of these, one bird and one reptile species recorded in 1984 were not recorded in 2001-2 and one mammal and one bird species not recorded in 1984 were recorded during this current study. This has more to do with the vagaries of sampling, the years since the last major fire and preceding and current weather conditions rather than the localised impact of mining.

As for most areas following an intensive study such as this, most resident birds have probably been observed and some migrant and nomadic species have also been noted. Those birds that have not as yet been recorded may include some extremely uncommon resident species, vagrants and some nomadic birds that will only appear when seasonal conditions are suitable for them.

The number, distribution and movement of Chuditch captured during this study were of particular interest, not only when compared to 1984 but in comparison with other areas of Jarrah forest.

As discussed earlier, frogs have almost certainly been under-sampled following the exceptionally dry autumn and winter experienced prior to the study. Most of the reptile groups have been successfully sampled with the exception of geckos and snakes.

## **7.2 Recommendations**

As there are no additional development proposals to be considered for this study, recommendations are limited to requirements for further effort to clarify issues that have arisen during the course of the work. Most obvious, is the potential for additional sampling following at least two years of relatively normal or above average rainfall. This would provide a more complete and current inventory of the vertebrate fauna of the BGM study area, particularly frogs.

More immediately, as many of the female Chuditch appeared to have lost body condition, and their pouch young, between the August and September/October sampling, it is recommended that further sampling of this species is undertaken in the near future to determine whether the population is in decline within the BGM and/or whether successful breeding had taken place.

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**APPENDIX 1** List of mammal, amphibian and reptile species recorded in the ten systematic sites at the Boddington Gold Mine (BG01 – BG10) in spring 2001, autumn and winter 2002. (Opportunistic results have been amalgamated in one column - OP).

**KEY**

- \* = Rare, threatened or vulnerable species.  
 S = Signs such as scats, tracks or diggings (counted as 1 animal).  
 RC = Recapture (where this is not preceded by a number, it shows a recaptured animal originally marked in another site; in this instance it is counted as 1 individual for the recapture site only).  
 Trip Number = 1 - spring, 2 - autumn, 3 - winter.

| STUDY AREA                                    | BODDINGTON GOLD MINE |          |          |           |          |          |           |          |           |           |           |          |           |          |          |           |          |           |          |          |          |           |          |          |           |          |          |          |          |          |          |          |          |          |          |   |          |          |   |
|---|----------------------|----------|----------|-----------|----------|----------|-----------|----------|-----------|-----------|-----------|----------|-----------|----------|----------|-----------|----------|-----------|----------|----------|----------|-----------|----------|----------|-----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---|----------|----------|---|
|   | SITE CODE            |          |          | BG01      |          |          | BG02      |          |           | BG03      |           |          | BG04      |          |          | BG05      |          |           | BG06     |          |          | BG07      |          |          | BG08      |          |          | BG09     |          |          | BG10     |          |          |          |          |   |          |          |   |
|   | TRIP NUMBER          | 1        | 2        | 3         | 1        | 2        | 3         | 1        | 2         | 3         | 1         | 2        | 3         | 1        | 2        | 3         | 1        | 2         | 3        | 1        | 2        | 3         | 1        | 2        | 3         | 1        | 2        | 3        | 1        | 2        | 3        |          |          |          |          |   |          |          |   |
| <b>NATIVE MAMMALS</b>                         |                      |          |          |           |          |          |           |          |           |           |           |          |           |          |          |           |          |           |          |          |          |           |          |          |           |          |          |          |          |          |          |          |          |          |          |   |          |          |   |
| <b>TACHYGLOSSIDAE</b>                         |                      |          |          |           |          |          |           |          |           |           |           |          |           |          |          |           |          |           |          |          |          |           |          |          |           |          |          |          |          |          |          |          |          |          |          |   |          |          |   |
| <i>Tachyglossus aculeatus</i>                 |                      |          |          | 1         |          |          |           |          |           |           |           |          |           |          |          | S         |          | S         |          |          |          |           |          |          |           |          | 1        | S        |          |          |          |          |          |          |          |   |          |          |   |
| <b>DASYURIDAE</b>                             |                      |          |          |           |          |          |           |          |           |           |           |          |           |          |          |           |          |           |          |          |          |           |          |          |           |          |          |          |          |          |          |          |          |          |          |   |          |          |   |
| <i>Dasyurus geoffroii</i>                     |                      |          |          |           |          |          |           |          | 4         | 1+        |           |          | 1         | 2+       | RC       | 3         | 4        |           |          |          | 4+       | RC        | 2        | RC       | 1         | 3        |          | 1+       | 1+       | 1        | 2        | 1        | 2        | 2        |          |   |          |          |   |
| <i>Phascogale tapoatafa</i>                   |                      | 1        |          |           |          |          |           |          |           |           |           |          | 1         |          |          | 2         |          |           | 1        | 2        |          |           |          |          |           |          |          |          |          |          |          |          |          |          |          |   |          |          |   |
| <i>Antechinus flavipes</i>                    |                      |          |          |           | 1        | 2        |           |          | 4         |           |           |          |           |          | 2        | 3         |          |           | 2        | 1        |          |           | 1        |          |           | 1        | 2        |          |          |          |          |          |          |          |          |   |          |          |   |
| <b>PERAMELIDAE</b>                            |                      |          |          |           |          |          |           |          |           |           |           |          |           |          |          |           |          |           |          |          |          |           |          |          |           |          |          |          |          |          |          |          |          |          |          |   |          |          |   |
| <i>Isodon obesulus fusciventer</i>            |                      |          |          |           |          | 1        |           |          |           |           |           |          |           |          |          |           |          |           |          |          | 1        | 1         |          |          |           | 1        | 1        | 1        | 2        | 1        |          |          |          |          |          |   |          |          |   |
| <b>PHALANGERIDAE</b>                          |                      |          |          |           |          |          |           |          |           |           |           |          |           |          |          |           |          |           |          |          |          |           |          |          |           |          |          |          |          |          |          |          |          |          |          |   |          |          |   |
| <i>Trichosurus v. vulpecula</i>               |                      | 1+       |          |           |          |          |           |          | 1         |           |           |          |           |          |          |           |          |           |          |          |          |           |          |          |           |          |          |          |          |          |          | S        | 1        | S        |          |   |          |          |   |
| <b>MACROPODIDAE</b>                           |                      |          |          |           |          |          |           |          |           |           |           |          |           |          |          |           |          |           |          |          |          |           |          |          |           |          |          |          |          |          |          |          |          |          |          |   |          |          |   |
| <i>Macropus irma</i>                          |                      | 2        |          |           | 1        |          |           |          |           |           |           |          |           |          |          |           |          |           |          |          |          |           |          |          |           | 2        |          |          |          |          |          |          |          |          |          |   |          |          |   |
| <i>Macropus fuliginosus</i>                   |                      | 7        | 3        | 4         | 1        |          | 2         | 15       | 2         | 9         | 2         | 30       | 1         | 30       |          |           |          | 2         | 2        | 2        | 1        |           |          |          | S         | S        |          | 3        | 1        | 3        |          | S        |          |          |          |   |          |          |   |
| <b>Total number of species per season</b>     | <b>2</b>             | <b>4</b> | <b>2</b> | <b>4</b>  | <b>2</b> | <b>3</b> | <b>3</b>  | <b>2</b> | <b>2</b>  | <b>2</b>  | <b>2</b>  | <b>3</b> | <b>3</b>  | <b>2</b> | <b>4</b> | <b>1</b>  | <b>3</b> | <b>5</b>  | <b>3</b> | <b>2</b> | <b>2</b> | <b>3</b>  | <b>3</b> | <b>4</b> | <b>4</b>  | <b>3</b> | <b>3</b> | <b>2</b> | <b>3</b> | <b>2</b> | <b>3</b> | <b>2</b> |          |          |          |   |          |          |   |
| <b>Total number of individuals per season</b> | <b>9</b>             | <b>7</b> | <b>5</b> | <b>4</b>  | <b>2</b> | <b>5</b> | <b>20</b> | <b>3</b> | <b>13</b> | <b>3</b>  | <b>33</b> | <b>5</b> | <b>34</b> | <b>6</b> | <b>6</b> | <b>2</b>  | <b>5</b> | <b>10</b> | <b>4</b> | <b>2</b> | <b>2</b> | <b>6</b>  | <b>3</b> | <b>5</b> | <b>6</b>  | <b>4</b> | <b>3</b> | <b>3</b> | <b>2</b> | <b>4</b> | <b>3</b> | <b>2</b> | <b>4</b> | <b>3</b> |          |   |          |          |   |
| <b>Total number of species per year</b>       | <b>5</b>             |          |          | <b>6</b>  |          |          | <b>4</b>  |          |           | <b>3</b>  |           |          | <b>5</b>  |          |          | <b>5</b>  |          |           | <b>5</b> |          |          | <b>6</b>  |          |          | <b>4</b>  |          |          | <b>3</b> |          |          |          |          |          |          |          |   |          |          |   |
| <b>Total number of individuals per year</b>   | <b>20</b>            |          |          | <b>11</b> |          |          | <b>36</b> |          |           | <b>40</b> |           |          | <b>46</b> |          |          | <b>17</b> |          |           | <b>8</b> |          |          | <b>14</b> |          |          | <b>13</b> |          |          | <b>9</b> |          |          |          |          |          |          |          |   |          |          |   |
| <b>INTRODUCED MAMMALS</b>                     |                      |          |          |           |          |          |           |          |           |           |           |          |           |          |          |           |          |           |          |          |          |           |          |          |           |          |          |          |          |          |          |          |          |          |          |   |          |          |   |
| <b>MURIDAE</b>                                |                      |          |          |           |          |          |           |          |           |           |           |          |           |          |          |           |          |           |          |          |          |           |          |          |           |          |          |          |          |          |          |          |          |          |          |   |          |          |   |
| <i>Mus musculus</i>                           |                      |          |          |           |          |          |           |          |           |           |           |          |           |          |          |           |          |           |          |          |          |           |          |          |           |          |          |          |          |          |          |          |          | 1        |          |   |          |          |   |
| <b>LEPORIDAE</b>                              |                      |          |          |           |          |          |           |          |           |           |           |          |           |          |          |           |          |           |          |          |          |           |          |          |           |          |          |          |          |          |          |          |          |          |          |   |          |          |   |
| <i>Oryctolagus cuniculus</i>                  |                      | 1        | 1        |           |          | 1        |           |          |           |           |           |          |           |          |          |           |          |           |          |          |          |           |          |          |           |          |          |          |          |          |          |          |          |          |          |   |          |          |   |
| <b>CANIDAE</b>                                |                      |          |          |           |          |          |           |          |           |           |           |          |           |          |          |           |          |           |          |          |          |           |          |          |           |          |          |          |          |          |          |          |          |          |          |   |          |          |   |
| <i>Vulpes vulpes</i>                          |                      |          |          | 2         |          |          |           |          | 2         |           |           |          |           |          |          |           |          |           |          |          |          |           |          |          |           |          | 2        |          |          |          |          |          |          |          |          |   |          |          |   |
| <b>FELIDAE</b>                                |                      |          |          |           |          |          |           |          |           |           |           |          |           |          |          |           |          |           |          |          |          |           |          |          |           |          |          |          |          |          |          |          |          |          |          |   |          |          |   |
| <i>Felis catus</i>                            |                      |          |          |           |          |          |           |          |           |           |           |          |           |          |          |           |          |           |          |          |          |           |          |          |           |          | 1        |          |          |          |          |          |          |          |          |   |          |          |   |
| <b>SUIDAE</b>                                 |                      |          |          |           |          |          |           |          |           |           |           |          |           |          |          |           |          |           |          |          |          |           |          |          |           |          |          |          |          |          |          |          |          |          |          |   |          |          |   |
| <i>Sus scrofa</i>                             |                      |          |          |           |          | 2        |           |          | 1         |           |           |          | 4         |          | 1        |           |          |           |          |          |          |           |          |          |           | 1        | 1        | 1        |          | 1        | 1        |          | 1        | 1        |          |   |          |          |   |
| <b>Total number of species per season</b>     | -                    | <b>1</b> | <b>2</b> | -         | -        | <b>2</b> | -         | <b>2</b> | -         | -         | -         | -        | <b>1</b>  | -        | <b>1</b> | -         | -        | -         | -        | -        | -        | -         | -        | -        | -         | -        | -        | -        | -        | -        | -        | -        | <b>3</b> | <b>1</b> | <b>1</b> | - | <b>1</b> | <b>2</b> | - |
| <b>Total number of individuals per season</b> | -                    | <b>1</b> | <b>3</b> | -         | -        | <b>3</b> | -         | <b>3</b> | -         | -         | -         | -        | <b>4</b>  | -        | <b>1</b> | -         | -        | -         | -        | -        | -        | -         | -        | -        | -         | -        | -        | -        | -        | -        | -        | -        | <b>4</b> | <b>1</b> | <b>1</b> | - | <b>1</b> | <b>2</b> | - |
| <b>Total number of species per year</b>       | <b>2</b>             |          |          | <b>2</b>  |          |          | <b>2</b>  |          |           | <b>1</b>  |           |          | <b>1</b>  |          |          | <b>-</b>  |          |           | <b>-</b> |          |          | <b>3</b>  |          |          | <b>1</b>  |          |          | <b>2</b> |          |          |          |          |          |          |          |   |          |          |   |
| <b>Total number of individuals per year</b>   | <b>4</b>             |          |          | <b>3</b>  |          |          | <b>3</b>  |          |           | <b>4</b>  |           |          | <b>1</b>  |          |          | <b>-</b>  |          |           | <b>-</b> |          |          | <b>4</b>  |          |          | <b>2</b>  |          |          | <b>3</b> |          |          |          |          |          |          |          |   |          |          |   |

| STUDY AREA                                    |                                 | BODDINGTON GOLD MINE |          |           |           |          |          |           |          |          |           |          |          |           |          |           |           |          |          |           |          |          |           |          |          |           |          |           |           |          |          |    |  |
|---|---------------------------------|----------------------|----------|-----------|-----------|----------|----------|-----------|----------|----------|-----------|----------|----------|-----------|----------|-----------|-----------|----------|----------|-----------|----------|----------|-----------|----------|----------|-----------|----------|-----------|-----------|----------|----------|----|--|
| SITE CODE                                     |                                 | BG01                 |          |           | BG02      |          |          | BG03      |          |          | BG04      |          |          | BG05      |          |           | BG06      |          |          | BG07      |          |          | BG08      |          |          | BG09      |          |           | BG10      |          |          |    |  |
| TRIP NUMBER                                   |                                 | 1                    | 2        | 3         | 1         | 2        | 3        | 1         | 2        | 3        | 1         | 2        | 3        | 1         | 2        | 3         | 1         | 2        | 3        | 1         | 2        | 3        | 1         | 2        | 3        | 1         | 2        | 3         | 1         | 2        | 3        |    |  |
| <b>AMPHIBIANS</b>                             |                                 |                      |          |           |           |          |          |           |          |          |           |          |          |           |          |           |           |          |          |           |          |          |           |          |          |           |          |           |           |          |          |    |  |
| <b>MYOBATRACHIDAE</b>                         |                                 |                      |          |           |           |          |          |           |          |          |           |          |          |           |          |           |           |          |          |           |          |          |           |          |          |           |          |           |           |          |          |    |  |
| <i>Crinia georgiana</i>                       | Quacking Frog                   |                      | 3        | 1         |           |          |          |           |          |          |           |          |          |           |          | 2         |           |          |          |           |          | 1        | 1         |          |          |           |          |           |           |          |          | 1  |  |
| <i>Crinia glauerti</i>                        | Glauert's Froglet               |                      | 1        | 3         |           |          |          |           |          |          |           |          |          |           |          | 3         |           |          |          |           |          |          |           |          |          |           |          |           |           |          |          | 18 |  |
| <i>Crinia pseudinsignifera</i>                | Bleating Froglet                | 1                    | 1        | 20        |           |          |          | 1         | 1        | 1        |           |          |          |           |          | 1         | 15        |          |          |           |          |          | 2         |          |          | 1         | 15       | 4         | 36        | 1        | 1        |    |  |
| <i>Heleioporus inornatus</i>                  | Whooping Frog                   |                      |          |           |           |          |          |           |          |          |           |          |          |           |          | 1         |           |          |          |           |          |          |           |          |          |           |          |           |           |          |          |    |  |
| <i>Heleioporus sp.</i>                        | Unidentified <i>Heleioporus</i> |                      |          |           |           |          |          |           |          |          |           |          |          |           |          |           |           |          |          |           |          | 1        |           |          |          |           |          |           |           |          |          |    |  |
| <i>Limnodynastes dorsalis</i>                 | Banjo Frog                      |                      |          |           |           |          |          |           | 1        |          |           |          |          |           |          |           |           |          |          |           |          |          |           |          |          |           |          |           |           |          |          |    |  |
| <i>Pseudophryne guentheri</i>                 | Guenther's Toadlet              |                      |          |           |           |          |          |           |          |          |           |          |          |           | 5        | 4         |           |          | 1        |           |          |          |           |          |          |           |          |           | 1         |          |          |    |  |
| <b>HYLIDAE</b>                                |                                 |                      |          |           |           |          |          |           |          |          |           |          |          |           |          |           |           |          |          |           |          |          |           |          |          |           |          |           |           |          |          |    |  |
| <i>Litoria adelaidensis</i>                   | Slender Tree Frog               |                      |          |           |           |          |          |           |          |          |           |          |          |           |          |           |           |          |          |           |          |          |           |          |          |           |          |           |           |          |          | 10 |  |
| <b>Total number of species per season</b>     |                                 | <b>1</b>             | <b>3</b> | <b>3</b>  | <b>-</b>  | <b>-</b> | <b>-</b> | <b>1</b>  | <b>2</b> | <b>1</b> | <b>-</b>  | <b>-</b> | <b>-</b> | <b>-</b>  | <b>2</b> | <b>5</b>  | <b>-</b>  | <b>-</b> | <b>1</b> | <b>-</b>  | <b>1</b> | <b>2</b> | <b>1</b>  | <b>-</b> | <b>1</b> | <b>1</b>  | <b>2</b> | <b>4</b>  | <b>1</b>  | <b>1</b> | <b>-</b> |    |  |
| <b>Total number of individuals per season</b> |                                 | <b>1</b>             | <b>5</b> | <b>24</b> | <b>-</b>  | <b>-</b> | <b>-</b> | <b>1</b>  | <b>2</b> | <b>1</b> | <b>-</b>  | <b>-</b> | <b>-</b> | <b>-</b>  | <b>6</b> | <b>25</b> | <b>-</b>  | <b>-</b> | <b>1</b> | <b>-</b>  | <b>1</b> | <b>2</b> | <b>2</b>  | <b>-</b> | <b>1</b> | <b>15</b> | <b>5</b> | <b>65</b> | <b>1</b>  | <b>1</b> | <b>-</b> |    |  |
| <b>Total number of species per year</b>       |                                 | <b>3</b>             |          |           | <b>-</b>  |          |          | <b>2</b>  |          |          | <b>-</b>  |          |          | <b>5</b>  |          |           | <b>1</b>  |          |          | <b>2</b>  |          |          | <b>1</b>  |          |          | <b>5</b>  |          |           | <b>1</b>  |          |          |    |  |
| <b>Total number of individuals per year</b>   |                                 | <b>30</b>            |          |           | <b>-</b>  |          |          | <b>4</b>  |          |          | <b>-</b>  |          |          | <b>31</b> |          |           | <b>1</b>  |          |          | <b>3</b>  |          |          | <b>3</b>  |          |          | <b>85</b> |          |           | <b>2</b>  |          |          |    |  |
| <b>REPTILES</b>                               |                                 |                      |          |           |           |          |          |           |          |          |           |          |          |           |          |           |           |          |          |           |          |          |           |          |          |           |          |           |           |          |          |    |  |
| <b>GECKOS</b>                                 |                                 |                      |          |           |           |          |          |           |          |          |           |          |          |           |          |           |           |          |          |           |          |          |           |          |          |           |          |           |           |          |          |    |  |
| <i>Diplodactylus polyophthalmus</i>           |                                 |                      |          |           |           |          |          | 1         | 1        |          | 1         | 1        |          |           |          |           |           |          |          |           |          | 2        |           | 3        | 1        | 1         |          |           |           |          |          |    |  |
| <i>Aprasia pulchella</i>                      |                                 |                      |          |           |           |          |          |           |          |          |           |          |          |           |          | 2         |           |          |          |           |          |          |           |          |          |           |          |           |           |          |          | 1  |  |
| <i>Delma f. fraseri</i>                       | Fraser's Legless Lizard         |                      |          |           |           |          |          |           |          |          |           |          |          |           |          |           |           |          |          |           |          | 1        |           |          |          |           |          |           |           |          |          |    |  |
| <b>AGAMIDAE</b>                               |                                 |                      |          |           |           |          |          |           |          |          |           |          |          |           |          |           |           |          |          |           |          |          |           |          |          |           |          |           |           |          |          |    |  |
| <i>Pogona m. minor</i>                        | Western Bearded Dragon          |                      | 1        |           |           |          |          |           |          |          |           |          |          |           |          |           |           |          |          |           |          |          |           |          |          | 1         |          |           |           |          |          |    |  |
| <b>SKINKS</b>                                 |                                 |                      |          |           |           |          |          |           |          |          |           |          |          |           |          |           |           |          |          |           |          |          |           |          |          |           |          |           |           |          |          |    |  |
| <i>Acritoscincus trilineatum</i>              |                                 |                      |          |           |           |          |          | 1         |          |          | 1         |          |          |           |          |           |           |          |          |           |          |          |           |          |          |           |          |           |           |          |          |    |  |
| <i>Cryptoblepharus plagiocephalus</i>         | Fence Skink                     | 8                    | 2        |           | 2         |          |          |           |          |          |           |          |          | 1         |          |           | 1         |          |          |           |          | 3        | 2         |          |          |           |          |           |           | 1        |          |    |  |
| <i>Ctenotus delli</i>                         | Dell's Skink                    |                      |          |           |           |          |          |           |          |          |           |          |          |           |          |           |           |          |          |           |          | 1        |           |          |          |           |          |           |           |          |          |    |  |
| <i>Egernia napoleonis</i>                     |                                 | 1                    |          |           | 5         |          |          |           |          |          | 1         |          |          | 1         |          |           |           |          |          |           |          | 1        | 1         |          |          |           |          |           |           | 2        |          |    |  |
| <i>Hemiergus i. initialis</i>                 |                                 | 2                    |          |           | 3         |          |          | 1         | 1        |          | 2         |          |          | 2         | 1        |           |           |          |          |           |          | 5        | 3         |          |          | 1         |          |           |           | 3        |          |    |  |
| <i>Lerista distinguenda</i>                   |                                 | 2                    |          |           | 5         |          |          | 3         |          |          | 12        |          |          | 1         |          |           | 1         |          |          |           |          | 8        | 1         |          |          | 1         | 1        |           |           | 1        | 6        |    |  |
| <i>Menetia greyii</i>                         | Common Dwarf Skink              | 3                    | 1        |           | 4         | 1        |          |           |          |          |           |          |          | 2         | 4        |           | 16        |          |          |           |          | 13       | 1         |          |          | 1         | 1        |           |           | 4        | 10       | 2  |  |
| <i>Morethia obscura</i>                       |                                 | 5                    | 1        |           |           |          |          | 6         |          |          | 8         | 1        |          |           |          |           |           |          |          |           |          | 5        | 1         |          |          |           |          |           | 3         | 1        | 2        | 4  |  |
| <i>Tiliqua r. rugosa</i>                      | Bobtail                         | 3                    |          |           |           |          |          |           |          |          |           |          |          |           |          |           | 1         |          |          |           |          |          |           |          |          |           |          |           | 1         |          |          |    |  |
| <b>VARANIDAE</b>                              |                                 |                      |          |           |           |          |          |           |          |          |           |          |          |           |          |           |           |          |          |           |          |          |           |          |          |           |          |           |           |          |          |    |  |
| <i>Varanus rosenbergi</i>                     | Rosenberg's Goanna              |                      |          |           |           |          |          | 1         |          |          |           |          |          | 1         |          |           | 1         |          |          |           |          |          |           |          |          |           |          |           |           |          |          |    |  |
| <b>TYPHLOPIDAE</b>                            |                                 |                      |          |           |           |          |          |           |          |          |           |          |          |           |          |           |           |          |          |           |          |          |           |          |          |           |          |           |           |          |          |    |  |
| <i>Ramphotyphlops australis</i>               |                                 | 1                    |          |           |           |          |          |           |          |          |           |          |          |           |          |           |           |          |          |           |          |          |           |          |          |           |          |           |           |          |          |    |  |
| <b>ELAPIDAE</b>                               |                                 |                      |          |           |           |          |          |           |          |          |           |          |          |           |          |           |           |          |          |           |          |          |           |          |          |           |          |           |           |          |          |    |  |
| <i>Pseudonaja a. affinis</i>                  | Dugite                          |                      |          |           |           |          |          |           |          |          |           |          |          |           |          |           |           |          |          |           |          |          |           |          |          |           |          |           |           |          |          | 1  |  |
| <b>Total number of species per season</b>     |                                 | <b>8</b>             | <b>4</b> | <b>-</b>  | <b>5</b>  | <b>1</b> | <b>-</b> | <b>6</b>  | <b>2</b> | <b>-</b> | <b>6</b>  | <b>2</b> | <b>-</b> | <b>5</b>  | <b>2</b> | <b>-</b>  | <b>6</b>  | <b>-</b> | <b>-</b> | <b>9</b>  | <b>6</b> | <b>-</b> | <b>4</b>  | <b>4</b> | <b>1</b> | <b>5</b>  | <b>1</b> | <b>-</b>  | <b>7</b>  | <b>2</b> | <b>-</b> |    |  |
| <b>Total number of individuals per season</b> |                                 | <b>25</b>            | <b>5</b> | <b>-</b>  | <b>19</b> | <b>1</b> | <b>-</b> | <b>13</b> | <b>2</b> | <b>-</b> | <b>25</b> | <b>2</b> | <b>-</b> | <b>7</b>  | <b>5</b> | <b>-</b>  | <b>22</b> | <b>-</b> | <b>-</b> | <b>39</b> | <b>9</b> | <b>-</b> | <b>6</b>  | <b>4</b> | <b>1</b> | <b>10</b> | <b>1</b> | <b>-</b>  | <b>25</b> | <b>6</b> | <b>-</b> |    |  |
| <b>Total number of species per year</b>       |                                 | <b>9</b>             |          |           | <b>5</b>  |          |          | <b>6</b>  |          |          | <b>6</b>  |          |          | <b>5</b>  |          |           | <b>6</b>  |          |          | <b>9</b>  |          |          | <b>5</b>  |          |          | <b>5</b>  |          |           | <b>7</b>  |          |          |    |  |
| <b>Total number of individuals per year</b>   |                                 | <b>30</b>            |          |           | <b>20</b> |          |          | <b>15</b> |          |          | <b>27</b> |          |          | <b>12</b> |          |           | <b>22</b> |          |          | <b>48</b> |          |          | <b>11</b> |          |          | <b>11</b> |          |           | <b>31</b> |          |          |    |  |

**APPENDIX 2** *Chuditch capture, recapture and movement between sites at the BGM during the five surveys in 2001-2.*

| TATTOO #       | CAPTURE RATE | TRIP NO. | DATE       | LINE | MOVEMENT |
|----------------|--------------|----------|------------|------|----------|
| <b>FEMALES</b> |              |          |            |      |          |
| L82            | 1            | 1        | 25/11/2001 | BG08 | NO       |
|                | 2            | 1        | 22/11/2001 | BG08 |          |
| L83            | 1            | 1        | 22/11/2001 | BG08 | NO       |
|                | 2            | 4        | 16/08/2002 | BG08 |          |
|                | 3            | 4        | 17/08/2002 | BG08 |          |
| L84            | 1            | 1        | 23/11/2001 | BG04 | NO       |
|                | 2            | 3        | 10/07/2002 | BG04 |          |
| L86            | 1            | 1        | 23/11/2001 | BG03 | YES      |
|                | 2            | 1        | 25/11/2001 | BG02 |          |
|                | 3            | 1        | 26/11/2001 | BG03 |          |
|                | 4            | 2        | 23/04/2002 | BG03 |          |
|                | 5            | 2        | 25/04/2002 | BG02 |          |
|                | 6            | 2        | 27/04/2002 | BG02 |          |
|                | 7            | 2        | 28/04/2002 | BG02 |          |
|                | 8            | 5        | 14/09/2002 | BG03 |          |
|                | 9            | 5        | 16/09/2002 | BG02 |          |
|                | 10           | 5        | 17/09/2002 | BG02 |          |
|                | 11           | 5        | 18/09/2002 | BG02 |          |
|                | 12           | 5        | 19/09/2002 | BG02 |          |
| L87            | 1            | 1        | 25/11/2001 | BG07 | YES      |
|                | 2            | 3        | 8/07/2002  | BG07 |          |
|                | 3            | 3        | 9/07/2002  | BG07 |          |
|                | 4            | 3        | 10/07/2002 | BG07 |          |
|                | 5            | 3        | 11/07/2002 | BG07 |          |
|                | 6            | 5        | 15/09/2002 | BG09 |          |
|                | 7            | 5        | 16/09/2002 | BG07 |          |
|                | 8            | 5        | 17/09/2002 | BG07 |          |
|                | 9            | 5        | 18/09/2002 | BG07 |          |
| L90            | 1            | 1        | 25/11/2001 | BG09 | NO       |
| L91            | 1            | 1        | 25/11/2001 | BG03 | YES      |
|                | 2            | 2        | 26/04/2002 | BG04 |          |
| L93            | 1            | 1        | 25/11/2001 | BG05 | NO       |
|                | 2            | 3        | 9/07/2002  | BG05 |          |
| L96            | 1            | 1        | 27/11/2001 | BG03 | YES      |
|                | 2            | 2        | 24/04/2002 | BG01 |          |
|                | 3            | 2        | 26/04/2002 | BG01 |          |
|                | 4            | 3        | 7/07/2002  | BG01 |          |
|                | 5            | 3        | 11/07/2002 | BG01 |          |
|                | 6            | 5        | 15/09/2002 | BG02 |          |
|                | 7            | 5        | 17/09/2002 | BG01 |          |
|                | 8            | 5        | 19/09/2002 | BG01 |          |



| TATTOO # | CAPTURE RATE | TRIP NO. | DATE       | LINE | MOVEMENT |
|----------|--------------|----------|------------|------|----------|
| L97      | 1            | 2        | 23/04/2002 | BG09 | NO       |
|          | 2            | 2        | 28/04/2002 | BG09 |          |
|          | 3            | 3        | 6/07/2002  | BG09 |          |
|          | 4            | 3        | 8/07/2002  | BG09 |          |
| L08      | 1            | 2        | 25/04/2002 | BG10 | NO       |
|          | 2            | 2        | 26/04/2002 | BG10 |          |
|          | 3            | 2        | 28/04/2002 | BG10 |          |
| L10      | 1            | 2        | 26/04/2002 | BG05 | YES      |
|          | 2            | 2        | 27/04/2002 | BG05 |          |
|          | 3            | 2        | 28/04/2002 | BG05 |          |
|          | 4            | 3        | 6/07/2002  | BG04 |          |
|          | 5            | 3        | 9/07/2002  | BG04 |          |
|          | 6            | 3        | 11/07/2002 | BG04 |          |
| L14      | 1            | 3        | 6/07/2002  | BG08 | YES      |
|          | 2            | 5        | 14/09/2002 | BG06 |          |
|          | 3            | 5        | 17/09/2002 | BG12 |          |
| L17      | 1            | 3        | 6/07/2002  | BG06 | NO       |
| L18      | 1            | 3        | 6/07/2002  | BG10 | NO       |
|          | 2            | 3        | 8/07/2002  | BG10 |          |
|          | 3            | 3        | 9/07/2002  | BG10 |          |
|          | 4            | 3        | 11/07/2002 | BG10 |          |
| L22      | 1            | 3        | 7/07/2002  | BG09 | YES      |
|          | 2            | 3        | 8/07/2002  | BG09 |          |
|          | 3            | 3        | 11/07/2002 | BG10 |          |
|          | 4            | 5        | 16/09/2002 | BG10 |          |
| L24      | 1            | 4        | 14/08/2002 | BG12 | YES      |
|          | 2            | 4        | 15/08/2002 | BG12 |          |
|          | 3            | 4        | 16/08/2002 | BG06 |          |
|          | 4            | 4        | 17/08/2002 | BG12 |          |
|          | 5            | 4        | 18/08/2002 | BG12 |          |
|          | 6            | 4        | 19/08/2002 | BG12 |          |
| L28      | 1            | 4        | 15/08/2002 | BG11 | NO       |
|          | 2            | 4        | 16/08/2002 | BG11 |          |
|          | 3            | 4        | 17/08/2002 | BG11 |          |
|          | 4            | 4        | 19/08/2002 | BG11 |          |
|          | 5            | 5        | 15/09/2002 | BG11 |          |
| L35      | 1            | 4        | 18/08/2002 | BG05 | NO       |
| L37      | 1            | 4        | 19/08/2002 | BG03 | NO       |
|          | 2            | 5        | 17/09/2002 | BG03 |          |
|          | 3            | 5        | 18/09/2002 | BG03 |          |
| L39      | 1            | 5        | 16/09/2002 | BG01 | NO       |
| L41      | 1            | 5        | 17/09/2002 | BG06 | NO       |

| TATTOO #     | CAPTURE RATE | TRIP NO. | DATE       | LINE | MOVEMENT |
|--------------|--------------|----------|------------|------|----------|
| <b>MALES</b> |              |          |            |      |          |
| R81          | 1            | 1        | 22/11/2001 | BG05 | NO       |
| R85          | 1            | 1        | 25/11/2001 | BG03 | YES      |
|              | 2            | 1        | 27/11/2001 | BG02 |          |
|              | 3            | 1        | 23/11/2001 | BG03 |          |
|              | 4            | 4        | 15/08/2002 | BG08 |          |
|              | 5            | 5        | 16/09/2002 | BG01 |          |
|              | 6            | 5        | 17/09/2002 | BG01 |          |
| R89          | 1            | 1        | 25/11/2001 | BG10 | YES      |
|              | 2            | 1        | 27/11/2001 | BG09 |          |
|              | 3            | 2        | 23/04/2002 | BG07 |          |
|              | 4            | 5        | 14/09/2002 | BG09 |          |
|              | 5            | 5        | 16/09/2002 | BG10 |          |
| R92          | 1            | 1        | 25/11/2001 | BG05 | NO       |
| R94          | 1            | 1        | 26/11/2001 | BG08 | NO       |
| R98          | 1            | 2        | 23/04/2002 | BG05 | NO       |
|              | 2            | 2        | 28/04/2002 | BG05 |          |
| R01          | 1            | 2        | 23/04/2002 | BG05 | NO       |
| R02          | 1            | 2        | 23/04/2002 | BG03 | NO       |
| R03          | 1            | 2        | 23/04/2002 | BG01 | NO       |
| R06          | 1            | 2        | 24/04/2002 | BG01 | YES      |
|              | 2            | 2        | 28/04/2002 | BG02 |          |
|              | 3            | 3        | 6/07/2002  | BG08 |          |
| R07          | 1            | 2        | 25/04/2002 | BG04 | YES      |
|              | 2            | 2        | 28/04/2002 | BG03 |          |
| R09          | 1            | 2        | 26/04/2002 | BG10 | NO       |
|              | 2            | 2        | 27/04/2002 | BG10 |          |
|              | 3            | 2        | 28/04/2002 | BG10 |          |
| R12          | 1            | 2        | 28/04/2002 | BG05 | YES      |
|              | 2            | 3        | 6/07/2002  | BG06 |          |
|              | 3            | 3        | 7/07/2002  | BG06 |          |
|              | 4            | 3        | 8/07/2002  | BG06 |          |
| R13          | 1            | 2        | 28/04/2002 | BG04 | NO       |
| R15          | 1            | 3        | 6/07/2002  | BG06 | NO       |
|              | 2            | 3        | 7/07/2002  | BG06 |          |
|              | 3            | 3        | 8/07/2002  | BG06 |          |

| TATTOO # | CAPTURE RATE | TRIP NO. | DATE       | LINE | MOVEMENT |
|----------|--------------|----------|------------|------|----------|
| R16      | 1            | 3        | 6/07/2002  | BG06 | YES      |
|          | 2            | 3        | 7/07/2002  | BG06 |          |
|          | 3            | 3        | 8/07/2002  | BG06 |          |
|          | 4            | 3        | 9/07/2002  | BG06 |          |
|          | 5            | 3        | 10/07/2002 | BG06 |          |
|          | 6            | 4        | 14/08/2002 | BG03 |          |
|          | 7            | 4        | 15/08/2002 | BG03 |          |
|          | 8            | 4        | 16/08/2002 | BG03 |          |
|          | 9            | 4        | 17/08/2002 | BG03 |          |
| R19      | 1            | 3        | 6/07/2002  | BG10 | NO       |
|          | 2            | 3        | 7/07/2002  | BG10 |          |
|          | 3            | 3        | 9/07/2002  | BG10 |          |
|          | 4            | 3        | 10/07/2002 | BG10 |          |
| R20      | 1            | 3        | 7/07/2002  | BG07 | NO       |
|          | 2            | 3        | 8/07/2002  | BG07 |          |
|          | 3            | 3        | 9/07/2002  | BG07 |          |
|          | 4            | 3        | 10/07/2002 | BG07 |          |
|          | 5            | 3        | 11/07/2002 | BG07 |          |
| R21      | 1            | 3        | 7/07/2002  | BG09 | YES      |
|          | 2            | 4        | 14/08/2002 | BG06 |          |
|          | 3            | 4        | 15/08/2002 | BG06 |          |
|          | 4            | 4        | 16/08/2002 | BG06 |          |
|          | 5            | 4        | 18/08/2002 | BG06 |          |
|          | 6            | 4        | 19/08/2002 | BG06 |          |
| R23      | 1            | 3        | 8/07/2002  | BG06 | YES      |
|          | 2            | 4        | 15/08/2002 | BG07 |          |
|          | 3            | 4        | 18/08/2002 | BG09 |          |
|          | 4            | 5        | 16/09/2002 | BG06 |          |
|          | 5            | 5        | 18/09/2002 | BG10 |          |
| R25      | 1            | 4        | 14/08/2002 | BG08 | YES      |
|          | 2            | 4        | 16/08/2002 | BG03 |          |
|          | 3            | 4        | 17/08/2002 | BG03 |          |
|          | 4            | 4        | 18/08/2002 | BG03 |          |
| R27      | 1            | 4        | 15/08/2002 | BG03 | NO       |
|          | 2            | 4        | 16/08/2002 | BG03 |          |
| R32      | 1            | 4        | 17/08/2002 | BG08 | YES      |
|          | 2            | 5        | 15/09/2002 | BG04 |          |
| R34      | 1            | 4        | 17/08/2002 | BG06 | NO       |
| R36      | 1            | 4        | 18/08/2002 | BG10 | NO       |



**APPENDIX 4** List of bird species recorded in the ten systematic sites at the Boddington Gold Mine (BG01 – BG10) in spring 2001, autumn and winter 2002. (Opportunistic results have been amalgamated in one column - OP).

**KEY**

\* = Rare, threatened or vulnerable species.  
 Trip Number = 1 - spring, 2 - autumn, 3 - winter.

| STUDY AREA                          | BODDINGTON GOLD MINE    |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |    |
|-------------------------------------|-------------------------|------|---|---|------|---|---|------|---|---|------|---|---|------|---|---|------|---|---|------|---|---|------|---|---|------|---|---|------|---|---|----|
|                                     | SITE NUMBER             | BG01 |   |   | BG02 |   |   | BG03 |   |   | BG04 |   |   | BG05 |   |   | BG06 |   |   | BG07 |   |   | BG08 |   |   | BG09 |   |   | BG10 |   |   | OP |
|                                     | TRIP NUMBER             | 1    | 2 | 3 | 1    | 2 | 3 | 1    | 2 | 3 | 1    | 2 | 3 | 1    | 2 | 3 | 1    | 2 | 3 | 1    | 2 | 3 | 1    | 2 | 3 | 1    | 2 | 3 | 1    | 2 | 3 |    |
| <b>NON-PASSERINE BIRDS</b>          |                         |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |    |
| <b>CASUARIIDAE</b>                  |                         |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |    |
| <i>Dromaius novaehollandiae</i>     | Emu                     | 1    |   | 1 | 1    | 1 |   | 1    |   |   |      | 1 |   |      | 1 |   |      |   |   |      | 1 | 1 |      |   |   | 1    | 1 | 1 | 1    | 1 |   | X  |
| <b>ANATIDAE</b>                     |                         |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |    |
| <i>Biziura lobata</i>               | Musk Duck               |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   | X  |
| <i>Cygnus atratus</i>               | Black Swan              |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   | X  |
| <i>Tadorna tadornoides</i>          | Australian Shelduck     |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   | X  |
| <i>Chenonetta jubata</i>            | Australian Wood Duck    |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   | 2 |      |   |   |      |   |   | X  |
| <i>Anas superciliosa</i>            | Pacific Black Duck      |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   | X  |
| <i>Anas gracilis</i>                | Grey Teal               |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   | X  |
| <b>PODICIPEDIDAE</b>                |                         |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |    |
| <i>Tachybaptus novaehollandiae</i>  | Australasian Grebe      |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   | X  |
| <i>Poliiocephalus poliocephalus</i> | Hoary-headed Grebe      |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   | X  |
| <b>PHALOCROCORACIDAE</b>            |                         |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |    |
| <i>Phalacrocorax carbo</i>          | Great Cormorant         |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   | X  |
| <i>Phalacrocorax melanoleucos</i>   | Little Pied Cormorant   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   | X  |
| <i>Phalacrocorax sulcirostris</i>   | Little Black Cormorant  |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   | X  |
| <b>ARDEIDAE</b>                     |                         |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |    |
| <i>Ardea pacifica</i>               | White-necked Heron      |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   | 2 |      |   |   |    |
| <i>Ardea novaehollandiae</i>        | White-faced Heron       |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   | X  |
| <b>THRESKIORNITHIDAE</b>            |                         |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |    |
| <i>Platalea flavipes</i>            | Yellow-billed Spoonbill |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   | X  |
| <b>ACCIPITRIDAE</b>                 |                         |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |    |
| <i>Accipiter fasciatus</i>          | Brown Goshawk           | 2    |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   | 1 |      |   |   |      |   |   |      |   |   |    |
| <i>Aquila audax</i>                 | Wedge-tailed Eagle      | 2    | 1 |   | 1    | 1 | 1 | 1    |   |   |      |   | 1 | 2    | 2 |   |      |   | 1 |      |   |   |      |   |   |      |   | 1 |      |   |   | X  |
| <i>Circus approximans</i>           | Swamp Harrier           |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   | X  |
| <i>Aquila morphnoides</i>           | Little Eagle            |      |   |   |      |   |   |      |   |   |      |   |   | 2    |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |    |
| <i>Hamirostra isura</i>             | Square-tailed Kite      |      |   |   |      |   | 1 |      |   |   |      |   |   |      |   |   |      |   |   |      |   | 1 |      |   |   |      |   |   |      |   |   |    |
| <b>FALCONIDAE</b>                   |                         |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |    |
| <i>Falco peregrinus</i>             | * Peregrine Falcon      |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   | X  |
| <b>RALLIDAE</b>                     |                         |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |    |
| <i>Fulica atra</i>                  | Eurasian Coot           |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   | X  |
| <b>TURNICIDAE</b>                   |                         |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |    |
| <i>Turnix varia</i>                 | Painted Button-quail    |      |   |   | 2    |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   | X  |
| <b>CHARADRIIDAE</b>                 |                         |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |    |
| <i>Charadrius melanops</i>          | Black-fronted Plover    |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   | X  |
| <b>COLUMBIDAE</b>                   |                         |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |    |
| <i>Phaps chalcoptera</i>            | Common Bronzewing       |      |   |   | 1    | 1 | 2 |      |   |   |      |   | 1 |      |   | 1 |      |   |   |      |   | 1 | 1    |   |   |      |   |   |      |   |   |    |
| <i>Phaps elegans</i>                | Brush Bronzewing        |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   |   |      |   | 2 | 2    |   |   |      |   |   |      |   |   |    |

| STUDY AREA                           |                                    | BODDINGTON GOLD MINE |    |    |      |   |   |      |   |    |      |   |    |      |    |    |      |    |    |      |    |   |      |    |   |      |    |   |      |    |   |    |   |   |   |   |
|--------------------------------------|------------------------------------|----------------------|----|----|------|---|---|------|---|----|------|---|----|------|----|----|------|----|----|------|----|---|------|----|---|------|----|---|------|----|---|----|---|---|---|---|
| SITE NUMBER                          |                                    | BG01                 |    |    | BG02 |   |   | BG03 |   |    | BG04 |   |    | BG05 |    |    | BG06 |    |    | BG07 |    |   | BG08 |    |   | BG09 |    |   | BG10 |    |   | OP |   |   |   |   |
| TRIP NUMBER                          |                                    | 1                    | 2  | 3  | 1    | 2 | 3 | 1    | 2 | 3  | 1    | 2 | 3  | 1    | 2  | 3  | 1    | 2  | 3  | 1    | 2  | 3 | 1    | 2  | 3 | 1    | 2  | 3 | 1    | 2  | 3 | 1  | 2 | 3 |   |   |
| <b>PSITTACIDAE</b>                   |                                    |                      |    |    |      |   |   |      |   |    |      |   |    |      |    |    |      |    |    |      |    |   |      |    |   |      |    |   |      |    |   |    |   |   |   |   |
| <i>Calyptorhynchus banksii naso</i>  | * Forest Red-tailed Black-Cockatoo | 3                    | 2  |    |      | 1 | 6 |      |   | 10 | 50   | 6 | 6  |      |    |    |      |    | 2  |      | 10 |   |      |    |   |      |    |   |      | 12 | 2 | 4  |   |   |   | X |
| <i>Calyptorhynchus latirostris</i>   | * Carnaby's Cockatoo               |                      |    |    |      |   |   |      |   |    |      |   |    |      |    |    | 35   | 22 |    | 2    |    |   | 30   |    |   |      |    |   | 6    |    | 5 |    |   |   | X |   |
| <i>Glossopsitta porphyrocephala</i>  | Purple-crowned Lorikeet            |                      |    |    |      |   |   |      |   |    |      |   |    |      |    | 2  | 2    |    |    |      |    |   |      |    |   |      |    |   |      |    |   |    |   |   |   |   |
| <i>Neophema elegans</i>              | Elegant Parrot                     |                      |    |    |      |   |   |      |   | 1  |      |   |    |      |    |    |      |    |    |      |    |   |      |    |   | 1    | 2  | 4 |      |    |   |    |   |   |   |   |
| <i>Platycercus icterotis</i>         | Western Rosella                    | 1                    | 1  |    |      |   |   |      |   | 1  |      |   |    |      |    |    |      |    |    |      |    |   |      |    |   | 1    |    | 2 | 1    |    |   |    |   |   | X |   |
| <i>Platycercus spurius</i>           | Red-capped Parrot                  | 1                    | 2  | 2  | 5    | 2 | 2 | 1    | 2 | 2  | 3    | 2 | 2  | 2    | 2  |    |      | 8  | 2  |      | 2  | 2 | 4    | 1  | 6 |      | 2  |   | 1    | 6  | 6 |    |   |   | X |   |
| <i>Platycercus zonarius</i>          | Australian Ringneck                | 2                    | 8  |    | 1    | 8 |   | 1    | 2 |    |      | 2 | 2  | 2    | 2  | 2  |      | 3  |    |      | 7  |   | 2    | 2  | 1 |      | 4  |   |      |    | 2 |    |   |   | X |   |
| <b>CUCULIDAE</b>                     |                                    |                      |    |    |      |   |   |      |   |    |      |   |    |      |    |    |      |    |    |      |    |   |      |    |   |      |    |   |      |    |   |    |   |   |   |   |
| <i>Chrysococcyx basalis</i>          | Horsfield's Bronze-Cuckoo          | 1                    |    |    |      |   |   |      |   |    |      |   |    |      |    |    |      |    |    |      |    |   |      |    |   |      |    |   |      |    |   |    |   |   |   |   |
| <i>Chrysococcyx lucidus</i>          | Shining Bronze-Cuckoo              | 1                    |    |    | 1    |   |   |      |   |    | 1    |   |    |      |    |    |      |    |    |      |    |   |      |    |   |      |    |   |      |    |   |    |   |   | X |   |
| <i>Cacomantis flabelliformis</i>     | Fan-tailed Cuckoo                  | 1                    | 1  | 1  |      |   |   |      |   | 1  |      |   | 2  |      |    | 1  |      |    | 1  |      |    | 1 |      |    |   |      |    | 1 |      |    | 1 |    |   |   |   |   |
| <b>PODARGIDAE</b>                    |                                    |                      |    |    |      |   |   |      |   |    |      |   |    |      |    |    |      |    |    |      |    |   |      |    |   |      |    |   |      |    |   |    |   |   |   |   |
| <i>Podargus strigoides</i>           | Tawny Frogmouth                    |                      |    |    | 2    |   |   |      |   |    |      |   |    |      |    |    |      |    |    |      |    |   |      |    |   |      |    |   |      |    |   |    |   |   |   |   |
| <b>AEGOTHELIDAE</b>                  |                                    |                      |    |    |      |   |   |      |   |    |      |   |    |      |    |    |      |    |    |      |    |   |      |    |   |      |    |   |      |    |   |    |   |   |   |   |
| <i>Aegotheles cristatus</i>          | Australian Owlet-nightjar          |                      |    |    |      |   |   |      |   | 1  |      |   |    |      |    |    |      |    | 1  |      |    |   |      |    |   |      |    |   |      |    |   |    |   |   |   |   |
| <b>HALCYONIDAE</b>                   |                                    |                      |    |    |      |   |   |      |   |    |      |   |    |      |    |    |      |    |    |      |    |   |      |    |   |      |    |   |      |    |   |    |   |   |   |   |
| <i>Todiramphus sanctus</i>           | Sacred Kingfisher                  | 1                    |    |    | 1    |   |   | 1    |   |    |      |   |    |      |    | 1  |      |    |    |      |    |   |      |    |   |      |    |   |      |    |   |    |   |   |   |   |
| <b>MEROPIIDAE</b>                    |                                    |                      |    |    |      |   |   |      |   |    |      |   |    |      |    |    |      |    |    |      |    |   |      |    |   |      |    |   |      |    |   |    |   |   |   |   |
| <i>Merops ornatus</i>                | * Rainbow Bee-eater                | 2                    |    |    |      |   |   |      |   |    | 1    |   |    |      |    |    |      |    |    |      |    |   | 3    |    |   |      |    |   |      |    |   |    |   |   |   |   |
| <b>PASSERINE BIRDS</b>               |                                    |                      |    |    |      |   |   |      |   |    |      |   |    |      |    |    |      |    |    |      |    |   |      |    |   |      |    |   |      |    |   |    |   |   |   |   |
| <b>CLIMACTERIDAE</b>                 |                                    |                      |    |    |      |   |   |      |   |    |      |   |    |      |    |    |      |    |    |      |    |   |      |    |   |      |    |   |      |    |   |    |   |   |   |   |
| <i>Climacteris rufa</i>              | Rufous Treecreeper                 |                      | 1  |    | 4    |   | 1 |      |   | 1  |      |   |    |      |    | 1  |      |    |    |      |    |   |      |    |   |      |    |   |      |    |   |    |   |   |   |   |
| <b>MALURIDAE</b>                     |                                    |                      |    |    |      |   |   |      |   |    |      |   |    |      |    |    |      |    |    |      |    |   |      |    |   |      |    |   |      |    |   |    |   |   |   |   |
| <i>Malurus elegans</i>               | Red-winged Fairy-wren              |                      |    |    |      |   |   |      |   |    |      |   |    |      |    |    |      |    |    |      |    |   | 2    |    |   |      |    | 2 |      |    |   |    |   |   | X |   |
| <i>Malurus splendens</i>             | Splendid Fairy-wren                | 5                    | 6  | 8  | 4    |   | 5 |      | 4 | 4  | 1    | 2 |    |      | 4  | 2  |      |    |    |      |    |   | 10   | 5  | 4 | 6    | 6  | 4 |      |    |   |    |   |   | X |   |
| <b>PARDALOTIDAE</b>                  |                                    |                      |    |    |      |   |   |      |   |    |      |   |    |      |    |    |      |    |    |      |    |   |      |    |   |      |    |   |      |    |   |    |   |   |   |   |
| <i>Pardalotus punctatus</i>          | Spotted Pardalote                  |                      |    |    |      |   |   |      |   |    | 1    |   |    | 2    |    |    |      | 1  |    | 1    |    |   | 1    |    |   | 1    | 1  | 1 |      |    |   |    |   |   | X |   |
| <i>Pardalotus striatus</i>           | Striated Pardalote                 | 6                    | 6  |    | 4    |   |   | 4    | 1 |    | 6    | 3 |    | 20   |    |    | 4    |    |    | 3    |    |   | 10   | 2  |   | 6    | 4  |   | 5    |    |   |    |   |   | X |   |
| <b>ACATHIZIDAE</b>                   |                                    |                      |    |    |      |   |   |      |   |    |      |   |    |      |    |    |      |    |    |      |    |   |      |    |   |      |    |   |      |    |   |    |   |   |   |   |
| <i>Acanthiza apicalis</i>            | Broad-tailed Thornbill             |                      | 2  | 4  | 4    | 4 | 2 | 2    | 3 | 6  | 3    | 2 | 10 |      | 4  | 8  | 2    | 4  |    | 4    | 6  | 8 | 2    | 6  | 6 | 3    | 4  | 6 | 2    | 2  | 3 |    |   |   | X |   |
| <i>Acanthiza chrysorrhoa</i>         | Yellow-rumped Thornbill            | 6                    | 6  | 8  |      |   |   |      |   | 10 |      |   | 4  | 4    |    |    |      |    |    |      |    |   | 6    |    | 5 | 4    | 6  | 6 |      |    | 6 |    |   |   | X |   |
| <i>Acanthiza inornata</i>            | Western Thornbill                  |                      |    | 6  | 3    | 6 | 4 | 3    | 8 | 4  | 6    | 4 | 12 |      | 6  | 2  | 5    | 8  | 6  | 6    | 4  | 6 | 1    | 4  | 4 | 10   | 4  | 3 | 5    | 8  | 4 |    |   |   | X |   |
| <i>Gerygone fusca</i>                | Western Gerygone                   | 4                    | 1  |    | 4    |   |   | 3    | 1 |    | 6    | 1 |    | 4    |    |    | 3    |    |    | 4    |    |   | 6    | 6  |   | 6    |    |   | 3    |    |   |    |   |   |   |   |
| <i>Sericornis frontalis</i>          | White-browed Scrubwren             |                      | 2  | 2  |      | 1 |   |      |   |    |      | 2 | 2  |      | 2  | 6  |      |    |    |      | 1  | 2 | 10   | 4  | 4 | 1    | 1  | 2 | 3    |    |   |    |   |   | X |   |
| <i>Smicronis brevirostris</i>        | Weebill                            | 10                   | 20 | 10 | 2    | 4 |   | 4    | 2 |    | 3    | 2 |    | 6    | 20 | 10 |      |    | 5  |      | 1  | 6 | 2    | 10 | 6 | 6    | 8  | 4 |      |    | 2 |    |   |   | X |   |
| <b>MELIPHAGIDAE</b>                  |                                    |                      |    |    |      |   |   |      |   |    |      |   |    |      |    |    |      |    |    |      |    |   |      |    |   |      |    |   |      |    |   |    |   |   |   |   |
| <i>Acanthorhynchus superciliosus</i> | Western Spinebill                  | 2                    | 6  | 4  | 2    | 2 | 2 | 1    | 2 | 2  | 1    | 2 | 8  | 4    | 2  | 2  | 6    | 8  | 12 | 2    | 2  | 4 | 10   | 2  | 3 | 8    | 4  | 4 | 2    | 2  | 3 |    |   |   | X |   |
| <i>Anthochaera carunculata</i>       | Red Wattlebird                     |                      |    |    |      | 1 |   |      | 1 |    |      |   |    |      |    |    | 1    |    |    |      |    |   | 1    | 1  |   |      |    |   | 1    |    |   |    |   |   |   |   |
| <i>Anthochaera lunulata</i>          | Little Wattlebird                  |                      |    |    |      |   |   |      | 1 |    | 2    |   |    |      |    |    |      | 4  | 4  |      |    |   |      |    |   |      |    |   |      |    |   |    |   |   |   |   |
| <i>Lichenostomus leucotis</i>        | White-eared Honeyeater             | 1                    |    |    |      |   |   |      |   |    |      |   |    |      |    |    |      |    |    |      |    |   |      |    |   |      |    |   |      |    |   |    |   |   |   |   |
| <i>Lichenostomus virescens</i>       | Singing Honeyeater                 | 2                    | 4  | 2  |      | 1 | 1 |      |   | 1  |      |   |    |      |    |    |      |    |    |      |    |   |      |    |   |      |    |   |      |    |   |    |   |   | X |   |
| <i>Lichmera indistincta</i>          | Brown Honeyeater                   | 20                   | 1  |    | 4    |   |   | 6    |   |    | 4    |   |    | 80   |    |    | 4    |    | 3  | 6    |    |   | 50   |    |   | 10   |    |   | 1    |    |   |    |   |   | X |   |
| <i>Melithreptus brevirostris</i>     | Brown-headed Honeyeater            | 3                    |    |    |      |   |   |      |   |    |      |   |    |      |    |    |      |    |    |      |    |   | 4    |    |   |      |    |   |      |    |   |    |   |   |   |   |
| <i>Melithreptus chloropsis</i>       | White-naped Honeyeater             | 4                    | 10 | 2  |      | 2 | 2 |      | 8 | 2  | 1    | 6 |    | 4    | 6  | 2  |      | 6  | 50 | 2    | 3  | 1 | 8    | 4  |   | 2    | 28 | 2 |      | 8  | 1 |    |   |   | X |   |

| STUDY AREA                          |   | BODDINGTON GOLD MINE |            |           |            |           |           |            |           |           |            |            |           |            |           |           |            |            |            |            |           |           |            |           |           |            |            |           |            |           |           |    |   |   |   |
|-------------------------------------|---|----------------------|------------|-----------|------------|-----------|-----------|------------|-----------|-----------|------------|------------|-----------|------------|-----------|-----------|------------|------------|------------|------------|-----------|-----------|------------|-----------|-----------|------------|------------|-----------|------------|-----------|-----------|----|---|---|---|
| SITE NUMBER                         |   | BG01                 |            |           | BG02       |           |           | BG03       |           |           | BG04       |            |           | BG05       |           |           | BG06       |            |            | BG07       |           |           | BG08       |           |           | BG09       |            |           | BG10       |           |           | OP |   |   |   |
| TRIP NUMBER                         |   | 1                    | 2          | 3         | 1          | 2         | 3         | 1          | 2         | 3         | 1          | 2          | 3         | 1          | 2         | 3         | 1          | 2          | 3          | 1          | 2         | 3         | 1          | 2         | 3         | 1          | 2          | 3         | 1          | 2         | 3         | 1  | 2 | 3 |   |
| <i>Phylidonyris melanops</i>        | Tawny-crowned Honeyeater                      |                      |            |           |            |           |           |            |           |           |            |            |           | 1          |           |           |            |            |            |            |           |           |            |           |           | 2          |            |           |            |           |           |    |   |   |   |
| <i>Phylidonyris novaehollandiae</i> | New Holland Honeyeater                        |                      |            |           |            |           |           |            |           |           | 3          |            |           |            |           |           | 40         | 20         |            |            |           | 2         | 40         | 8         | 8         | 6          | 2          | 6         |            |           |           |    |   |   | X |
| <b>PETROICIDAE</b>                  |   |                      |            |           |            |           |           |            |           |           |            |            |           |            |           |           |            |            |            |            |           |           |            |           |           |            |            |           |            |           |           |    |   |   |   |
| <i>Eopsaltria australis</i>         | Yellow Robin                                  | 1                    | 6          | 3         |            | 1         | 4         |            |           | 2         |            | 2          | 6         |            |           | 1         |            |            |            | 1          |           | 4         |            |           | 1         | 1          | 4          | 2         |            | 4         | 2         |    |   |   | X |
| <i>Eopsaltria georgiana</i>         | White-breasted Robin                          |                      |            |           |            |           |           |            |           |           |            |            |           |            |           |           |            |            |            |            |           |           |            |           |           | 1          |            | 2         |            |           |           |    |   |   | X |
| <i>Microeca fascianus</i>           | Jacky Winter                                  | 1                    |            |           |            |           |           |            |           |           |            |            |           |            |           |           |            |            |            |            |           |           |            |           |           |            |            |           |            |           |           |    |   |   |   |
| <i>Petroica goodenovii</i>          | Red-capped Robin                              | 3                    | 2          | 2         |            |           |           |            |           |           |            |            |           |            |           |           |            |            |            |            |           |           |            |           | 1         | 2          |            |           |            |           |           |    |   |   |   |
| <i>Petroica multicolor</i>          | Scarlet Robin                                 | 1                    | 4          | 2         | 2          | 2         | 1         |            | 2         | 2         |            | 4          | 2         | 1          | 2         | 3         |            | 4          |            |            |           | 2         | 1          | 1         | 2         | 2          | 1          | 2         | 1          | 2         | 2         |    | 2 | 1 | X |
| <b>NEOSITTIDAE</b>                  |   |                      |            |           |            |           |           |            |           |           |            |            |           |            |           |           |            |            |            |            |           |           |            |           |           |            |            |           |            |           |           |    |   |   |   |
| <i>Daphoenositta chrysoptera</i>    | Varied Sittella                               |                      |            |           | 4          | 8         |           |            | 6         |           |            |            |           |            |           |           |            |            |            |            |           | 6         |            |           |           |            |            |           | 8          | 7         |           |    |   |   | X |
| <b>PACHYCEPHALIDAE</b>              |   |                      |            |           |            |           |           |            |           |           |            |            |           |            |           |           |            |            |            |            |           |           |            |           |           |            |            |           |            |           |           |    |   |   |   |
| <i>Colluricincla harmonica</i>      | Grey Shrike-thrush                            | 1                    | 2          | 1         | 1          | 1         |           | 1          | 2         |           | 1          | 3          | 2         | 2          | 2         |           | 1          | 2          |            | 1          | 1         | 1         | 2          | 1         | 1         | 1          |            | 1         | 2          | 1         | 1         | 2  | 1 | 1 | X |
| <i>Pachycephala pectoralis</i>      | Golden Whistler                               | 2                    | 2          | 2         | 2          | 1         |           | 2          | 1         | 2         | 1          | 2          |           |            | 2         | 1         | 1          | 2          |            | 2          | 1         | 1         | 4          | 1         | 1         | 6          | 2          | 2         | 1          | 2         | 2         | 1  | 2 | 2 | X |
| <i>Pachycephala rufiventris</i>     | Rufous Whistler                               | 2                    |            | 1         |            | 1         |           |            |           | 2         |            |            | 1         | 1          |           |           |            | 1          |            | 1          |           |           | 1          |           |           | 1          |            | 1         |            |           |           |    |   |   | X |
| <b>DICRURIDAE</b>                   |   |                      |            |           |            |           |           |            |           |           |            |            |           |            |           |           |            |            |            |            |           |           |            |           |           |            |            |           |            |           |           |    |   |   |   |
| <i>Rhipidura fuliginosa</i>         | Grey Fantail                                  | 4                    | 4          | 2         | 2          | 6         | 2         |            | 2         | 2         |            | 2          | 2         | 1          | 3         | 2         | 2          | 2          | 2          | 4          | 2         | 2         | 4          | 2         | 2         | 4          | 4          | 2         | 2          | 4         | 1         |    |   |   | X |
| <i>Rhipidura leucophrys</i>         | Willie Wagtail                                |                      |            |           |            |           |           |            |           |           |            |            |           |            |           |           |            |            |            |            |           |           |            |           |           |            |            |           |            |           |           |    |   |   | X |
| <b>CAMPEPHAGIDAE</b>                |   |                      |            |           |            |           |           |            |           |           |            |            |           |            |           |           |            |            |            |            |           |           |            |           |           |            |            |           |            |           |           |    |   |   |   |
| <i>Coracina novaehollandiae</i>     | Black-faced Cuckoo-shrike                     |                      |            | 1         | 1          |           |           |            | 2         |           | 1          | 2          |           |            | 2         |           |            | 1          |            |            |           | 2         | 1          |           | 1         |            |            |           |            |           | 1         |    |   |   |   |
| <i>Lalage tricolor</i>              | White-winged Triller                          |                      |            |           |            |           |           |            |           |           |            |            |           | 3          |           |           |            |            |            |            |           |           |            |           |           |            |            |           |            |           |           |    |   |   |   |
| <b>ARTAMIDAE</b>                    |   |                      |            |           |            |           |           |            |           |           |            |            |           |            |           |           |            |            |            |            |           |           |            |           |           |            |            |           |            |           |           |    |   |   |   |
| <i>Artamus cyanopterus</i>          | Dusky Woodswallow                             | 1                    | 2          |           |            |           | 1         |            |           |           |            | 9          |           | 4          |           |           |            |            |            |            |           |           |            |           |           |            |            | 7         |            |           |           |    |   |   | X |
| <b>CRACTICIDAE</b>                  |   |                      |            |           |            |           |           |            |           |           |            |            |           |            |           |           |            |            |            |            |           |           |            |           |           |            |            |           |            |           |           |    |   |   |   |
| <i>Cracticus tibicen</i>            | Australian Magpie                             |                      | 2          | 4         | 2          |           |           |            | 2         |           |            |            | 2         |            | 15        | 5         |            |            |            |            |           |           |            |           | 1         |            |            |           |            |           |           |    |   |   |   |
| <b>CORVIDAE</b>                     |   |                      |            |           |            |           |           |            |           |           |            |            |           |            |           |           |            |            |            |            |           |           |            |           |           |            |            |           |            |           |           |    |   |   |   |
| <i>Corvus coronoides</i>            | Australian Raven                              | 2                    | 4          | 2         |            | 3         | 4         | 4          | 4         | 1         | 2          |            | 4         |            |           | 4         | 1          |            | 2          |            |           | 2         | 1          | 3         | 8         |            | 1          | 2         | 2          | 2         | 3         |    |   |   |   |
| <i>Strepera versicolor</i>          | Grey Currawong                                |                      |            | 2         |            |           |           |            | 2         |           | 2          | 1          | 1         |            | 1         | 2         | 2          | 1          |            |            | 1         | 3         | 2          |           |           | 1          | 2          | 4         | 2          | 2         | 1         |    |   |   |   |
| <b>HIRUNDINIDAE</b>                 |   |                      |            |           |            |           |           |            |           |           |            |            |           |            |           |           |            |            |            |            |           |           |            |           |           |            |            |           |            |           |           |    |   |   |   |
| <i>Hirundo neoxena</i>              | Welcome Swallow                               |                      |            |           |            |           |           |            |           |           |            |            |           |            |           |           |            |            |            |            |           |           |            |           |           |            |            |           |            |           |           |    |   |   | X |
| <i>Hirundo nigricans</i>            | Tree Martin                                   | 3                    | 6          |           |            | 4         |           |            | 1         |           |            | 50         |           | 4          |           |           |            | 5          |            | 6          | 10        |           | 12         |           | 1         |            | 4          |           |            |           |           |    |   |   | X |
| <b>ZOSTEROPIDAE</b>                 |   |                      |            |           |            |           |           |            |           |           |            |            |           |            |           |           |            |            |            |            |           |           |            |           |           |            |            |           |            |           |           |    |   |   |   |
| <i>Zosterops lateralis</i>          | Grey-breasted White-eye                       | 2                    | 4          | 2         | 3          | 4         | 2         |            | 6         | 4         |            | 1          |           | 10         | 4         |           | 3          | 12         | 8          | 6          |           | 2         | 10         | 6         | 2         | 10         | 2          | 4         |            | 4         |           |    |   |   | X |
|                                     | <b>Total number of species per season</b>     | <b>35</b>            | <b>29</b>  | <b>24</b> | <b>25</b>  | <b>23</b> | <b>17</b> | <b>19</b>  | <b>25</b> | <b>19</b> | <b>21</b>  | <b>23</b>  | <b>16</b> | <b>22</b>  | <b>22</b> | <b>18</b> | <b>16</b>  | <b>20</b>  | <b>13</b>  | <b>18</b>  | <b>16</b> | <b>21</b> | <b>34</b>  | <b>22</b> | <b>25</b> | <b>27</b>  | <b>24</b>  | <b>25</b> | <b>18</b>  | <b>15</b> | <b>16</b> |    |   |   |   |
|                                     | <b>Total number of individuals per season</b> | <b>104</b>           | <b>118</b> | <b>74</b> | <b>62</b>  | <b>65</b> | <b>41</b> | <b>39</b>  | <b>85</b> | <b>91</b> | <b>55</b>  | <b>110</b> | <b>62</b> | <b>192</b> | <b>85</b> | <b>55</b> | <b>42</b>  | <b>116</b> | <b>116</b> | <b>90</b>  | <b>45</b> | <b>63</b> | <b>212</b> | <b>79</b> | <b>73</b> | <b>118</b> | <b>113</b> | <b>73</b> | <b>43</b>  | <b>49</b> | <b>39</b> |    |   |   |   |
|                                     | <b>Total number of species per year</b>       | <b>42</b>            |            |           | <b>36</b>  |           |           | <b>39</b>  |           |           | <b>34</b>  |            |           | <b>39</b>  |           |           | <b>30</b>  |            |            | <b>32</b>  |           |           | <b>40</b>  |           |           | <b>36</b>  |            |           | <b>27</b>  |           |           |    |   |   |   |
|                                     | <b>Total number of individuals per year</b>   | <b>296</b>           |            |           | <b>168</b> |           |           | <b>215</b> |           |           | <b>227</b> |            |           | <b>332</b> |           |           | <b>274</b> |            |            | <b>198</b> |           |           | <b>364</b> |           |           | <b>304</b> |            |           | <b>131</b> |           |           |    |   |   |   |
| <b>INTRODUCED BIRDS</b>             |   |                      |            |           |            |           |           |            |           |           |            |            |           |            |           |           |            |            |            |            |           |           |            |           |           |            |            |           |            |           |           |    |   |   |   |
| <b>HALCYONIDAE</b>                  |   |                      |            |           |            |           |           |            |           |           |            |            |           |            |           |           |            |            |            |            |           |           |            |           |           |            |            |           |            |           |           |    |   |   |   |
| <i>Dacelo novaeguineae</i>          | Laughing Kookaburra                           | 4                    | 2          | 2         | 1          |           |           | 1          | 1         |           |            | 1          |           |            |           | 2         | 1          |            |            |            |           |           |            |           |           |            | 1          | 2         | 2          |           | 1         |    |   |   |   |

**APPENDIX 5** *Number of species recorded at the Boddington Gold Mine during 1984 and 2001-2. Both systematic and opportunistic sampling have been used.*

(X\* - additional waterbirds recorded during 1991 and 1992 at the various artificial lakes established for mining processes.)

| BIRDS                               |                         | SAMPLING YEAR | 1984 | 2001-2 |
|-------------------------------------|-------------------------|---------------|------|--------|
| <b>CASUARIIDAE</b>                  |                         |               |      |        |
| <i>Dromaius novaehollandiae</i>     | Emu                     |               | X    | X      |
| <b>ANATIDAE</b>                     |                         |               |      |        |
| <i>Biziura lobata</i>               | Musk Duck               |               | X*   | X      |
| <i>Cygnus atratus</i>               | Black Swan              |               | X*   | X      |
| <i>Tadorna tadornoides</i>          | Australian Shelduck     |               | X*   | X      |
| <i>Chenonetta jubata</i>            | Australian Wood Duck    |               | X*   | X      |
| <i>Anas superciliosa</i>            | Pacific Black Duck      |               | X    | X      |
| <i>Anas gracilis</i>                | Grey Teal               |               | X*   | X      |
| <i>Aythya australis</i>             | Hardhead                |               | X    |        |
| <b>PODICIPEDIDAE</b>                |                         |               |      |        |
| <i>Tachybaptus novaehollandiae</i>  | Australasian Grebe      |               | X*   | X      |
| <i>Poliiocephalus poliocephalus</i> | Hoary-headed Grebe      |               |      | X      |
| <b>PHALOCROCORACIDAE</b>            |                         |               |      |        |
| <i>Phalacrocorax carbo</i>          | Great Cormorant         |               |      | X      |
| <i>Phalacrocorax melanoleucos</i>   | Little Pied Cormorant   |               | X*   | X      |
| <i>Phalacrocorax sulcirostris</i>   | Little Black Cormorant  |               | X*   | X      |
| <b>ARDEIDAE</b>                     |                         |               |      |        |
| <i>Ardea pacifica</i>               | White-necked Heron      |               |      | X      |
| <i>Ardea novaehollandiae</i>        | White-faced Heron       |               | X*   | X      |
| <b>THRESKIORNITHIDAE</b>            |                         |               |      |        |
| <i>Platalea flavipes</i>            | Yellow-billed Spoonbill |               |      | X      |
| <b>ACCIPITRIDAE</b>                 |                         |               |      |        |
| <i>Accipiter fasciatus</i>          | Brown Goshawk           |               | X    | X      |
| <i>Accipiter cirrhocephalus</i>     | Collared Sparrowhawk    |               | X    |        |
| <i>Aquila audax</i>                 | Wedge-tailed Eagle      |               | X    | X      |
| <i>Circus approximans</i>           | Swamp Harrier           |               |      | X      |
| <i>Aquila morphnoides</i>           | Little Eagle            |               | X    | X      |
| <i>Hamirostra isura</i>             | Square-tailed Kite      |               |      | X      |
| <b>FALCONIDAE</b>                   |                         |               |      |        |
| <i>Falco longipennis</i>            | Australian Hobby        |               | X    |        |
| <i>Falco peregrinus</i>             | * Peregrine Falcon      |               |      | X      |
| <b>RALLIDAE</b>                     |                         |               |      |        |
| <i>Fulica atra</i>                  | Eurasian Coot           |               | X*   | X      |
| <b>TURNICIDAE</b>                   |                         |               |      |        |
| <i>Turnix varia</i>                 | Painted Button-quail    |               | X    | X      |
| <b>CHARADRIIDAE</b>                 |                         |               |      |        |
| <i>Charadrius melanops</i>          | Black-fronted Plover    |               | X*   | X      |
| <b>SCOLOPACIDAE</b>                 |                         |               |      |        |
| <i>Tringa hypoleucos</i>            | Common Sandpiper        |               | X*   |        |
| <b>COLUMBIDAE</b>                   |                         |               |      |        |
| <i>Phaps chalcoptera</i>            | Common Bronzewing       |               | X    | X      |



|                                      | <b>SAMPLING YEAR</b>               | <b>1984</b> | <b>2001-2</b> |
|--------------------------------------|------------------------------------|-------------|---------------|
| <i>Phaps elegans</i>                 | Brush Bronzewing                   |             | X             |
| <b>PSITTACIDAE</b>                   |                                    |             |               |
| <i>Calyptorhynchus banksii naso</i>  | * Forest Red-tailed Black-Cockatoo | X           | X             |
| <i>Calyptorhynchus latirostris</i>   | * Carnaby's Cockatoo               | X           | X             |
| <i>Calyptorhynchus baudinii</i>      | * Baudin's Cockatoo                | X           |               |
| <i>Glossopsitta porphyrocephala</i>  | Purple-crowned Lorikeet            | X           | X             |
| <i>Neophema elegans</i>              | Elegant Parrot                     | X           | X             |
| <i>Platycercus icterotis</i>         | Western Rosella                    | X           | X             |
| <i>Platycercus spurius</i>           | Red-capped Parrot                  | X           | X             |
| <i>Platycercus zonarius</i>          | Australian Ringneck                | X           | X             |
| <b>CUCULIDAE</b>                     |                                    |             |               |
| <i>Chrysococcyx basalis</i>          | Horsfield's Bronze-Cuckoo          | X           | X             |
| <i>Chrysococcyx lucidus</i>          | Shining Bronze-Cuckoo              | X           | X             |
| <i>Cacomantis flabelliformis</i>     | Fan-tailed Cuckoo                  | X           | X             |
| <b>STRIGIDAE</b>                     |                                    |             |               |
| <i>Ninox novaeseelandiae</i>         | Boobook Owl                        | X           |               |
| <b>PODARGIDAE</b>                    |                                    |             |               |
| <i>Podargus strigoides</i>           | Tawny Frogmouth                    | X           | X             |
| <b>AEGOTHELIDAE</b>                  |                                    |             |               |
| <i>Aegotheles cristatus</i>          | Australian Owlet-nightjar          | X           | X             |
| <b>HALCYONIDAE</b>                   |                                    |             |               |
| <i>Todiramphus sanctus</i>           | Sacred Kingfisher                  | X           | X             |
| <b>MEROPIDAE</b>                     |                                    |             |               |
| <i>Merops ornatus</i>                | * Rainbow Bee-eater                | X           | X             |
| <b>CLIMACTERIDAE</b>                 |                                    |             |               |
| <i>Climacteris rufa</i>              | Rufous Treecreeper                 | X           | X             |
| <b>MALURIDAE</b>                     |                                    |             |               |
| <i>Malurus elegans</i>               | Red-winged Fairy-wren              | X           | X             |
| <i>Malurus splendens</i>             | Splendid Fairy-wren                | X           | X             |
| <b>PARDALOTIDAE</b>                  |                                    |             |               |
| <i>Pardalotus punctatus</i>          | Spotted Pardalote                  | X           | X             |
| <i>Pardalotus striatus</i>           | Striated Pardalote                 | X           | X             |
| <b>ACATHIZIDAE</b>                   |                                    |             |               |
| <i>Acanthiza apicalis</i>            | Broad-tailed (Inland) Thornbill    | X           | X             |
| <i>Acanthiza chrysorrhoa</i>         | Yellow-rumped Thornbill            | X           | X             |
| <i>Acanthiza inornata</i>            | Western Thornbill                  | X           | X             |
| <i>Gerygone fusca</i>                | Western Gerygone                   | X           | X             |
| <i>Sericornis frontalis</i>          | White-browed Scrubwren             | X           | X             |
| <i>Smicromis brevirostris</i>        | Weebill                            | X           | X             |
| <b>MELIPHAGIDAE</b>                  |                                    |             |               |
| <i>Acanthorhynchus superciliosus</i> | Western Spinebill                  | X           | X             |
| <i>Anthochaera carunculata</i>       | Red Wattlebird                     | X           | X             |
| <i>Anthochaera lunulata</i>          | Little Wattlebird                  | X           | X             |
| <i>Lichenostomus leucotis</i>        | White-eared Honeyeater             |             | X             |
| <i>Lichenostomus virescens</i>       | Singing Honeyeater                 | X           | X             |
| <i>Lichenostomus ornatus</i>         | Yellow-plumed Honeyeater           | X           |               |
| <i>Lichmera indistincta</i>          | Brown Honeyeater                   | X           | X             |
| <i>Melithreptus brevirostris</i>     | Brown-headed Honeyeater            |             | X             |
| <i>Melithreptus chloropsis</i>       | White-naped Honeyeater             | X           | X             |
| <i>Phylidonyris melanops</i>         | Tawny-crowned Honeyeater           |             | X             |

|   | <b>SAMPLING YEAR</b>      | <b>1984</b> | <b>2001-2</b> |
|---|---------------------------|-------------|---------------|
| <i>Phylidonyris novaehollandiae</i>       | New Holland Honeyeater    | X           | X             |
| <i>Phylidonyris nigra</i>                 | White-cheeked Honeyeater  | X           |               |
| <b>PETROICIDAE</b>                        |                           |             |               |
| <i>Eopsaltria australis</i>               | Yellow Robin              | X           | X             |
| <i>Eopsaltria georgiana</i>               | White-breasted Robin      | X           | X             |
| <i>Microeca fascianus</i>                 | Jacky Winter              |             | X             |
| <i>Petroica goodenovii</i>                | Red-capped Robin          | X           | X             |
| <i>Petroica multicolor</i>                | Scarlet Robin             | X           | X             |
| <b>NEOSITTIDAE</b>                        |                           |             |               |
| <i>Daphoenositta chrysoptera</i>          | Varied Sittella           | X           | X             |
| <b>PACHYCEPHALIDAE</b>                    |                           |             |               |
| <i>Colluricincla harmonica</i>            | Grey Shrike-thrush        | X           | X             |
| <i>Pachycephala pectoralis</i>            | Golden Whistler           | X           | X             |
| <i>Pachycephala rufiventris</i>           | Rufous Whistler           | X           | X             |
| <b>DICRURIDAE</b>                         |                           |             |               |
| <i>Rhipidura fuliginosa</i>               | Grey Fantail              | X           | X             |
| <i>Rhipidura leucophrys</i>               | Willie Wagtail            |             | X             |
| <b>CAMPEPHAGIDAE</b>                      |                           |             |               |
| <i>Coracina novaehollandiae</i>           | Black-faced Cuckoo-shrike | X           | X             |
| <i>Lalage tricolor</i>                    | White-winged Triller      | X           | X             |
| <b>ARTAMIDAE</b>                          |                           |             |               |
| <i>Artamus cyanopterus</i>                | Dusky Woodswallow         | X           | X             |
| <b>CRACTICIDAE</b>                        |                           |             |               |
| <i>Cracticus tibicen</i>                  | Australian Magpie         | X           | X             |
| <b>CORVIDAE</b>                           |                           |             |               |
| <i>Corvus coronoides</i>                  | Australian Raven          | X           | X             |
| <i>Strepera versicolor</i>                | Grey Currawong            | X           | X             |
| <b>HIRUNDINIDAE</b>                       |                           |             |               |
| <i>Hirundo neoxena</i>                    | Welcome Swallow           |             | X             |
| <i>Hirundo nigricans</i>                  | Tree Martin               | X           | X             |
| <b>PLOCEIDAE</b>                          |                           |             |               |
| <i>Staganopleura oculata</i>              | Red-eared Firetail        | X           |               |
| <b>DICAEIDAE</b>                          |                           |             |               |
| <i>Dicaeum hirundinaceum</i>              | Mistletoebird             | X           |               |
| <b>ZOSTEROPIDAE</b>                       |                           |             |               |
| <i>Zosterops lateralis</i>                | Grey-breasted White-eye   | X           | X             |
| <b>Total number of species per survey</b> |                           | <b>77</b>   | <b>81</b>     |
| <b>Total number of species</b>            |                           | <b>100</b>  |               |
| <b>MAMMALS</b>                            |                           |             |               |
| <b>TACHYGLOSSIDAE</b>                     |                           |             |               |
| <i>Tachyglossus aculeatus</i>             | Echidna                   | X           | X             |
| <b>DASYURIDAE</b>                         |                           |             |               |
| <i>Phascogale tapoatafa</i>               | Common Wambenger          | X           | X             |
| <i>Sminthopsis gilberti</i>               | Gilbert's Dunnart         | X           |               |
| <i>Sminthopsis griseoventer</i>           | Grey-bellied Dunnart      | X           |               |
| <i>Dasyurus geoffroii</i>                 | Chuditch                  | X           | X             |
| <i>Antechinus flavipes</i>                | Mardo                     | X           | X             |
| <b>PERAMELIDAE</b>                        |                           |             |               |
| <i>Isodon obesulus fusciventer</i>        | Southern Brown Bandicoot  |             | X             |
| <b>BURRAMYIDAE</b>                        |                           |             |               |

| SAMPLING YEAR                             |                                 | 1984      | 2001-2   |
|---|---------------------------------|-----------|----------|
| <i>Cercartetus concinnus</i>              | <b>Western Pygmy Possum</b>     | X         |          |
| <b>PHALANGERIDAE</b>                      |                                 |           |          |
| <i>Trichosurus v. vulpecula</i>           | Common Brushtail Possum         |           | X        |
| <b>MACROPODIDAE</b>                       |                                 |           |          |
| <i>Macropus irma</i>                      | Western Brush Wallaby           | X         | X        |
| <i>Macropus fuliginosus</i>               | Western Grey Kangaroo           | X         | X        |
| <b>MOLOSSIDAE</b>                         |                                 |           |          |
| <i>Nyctinomus australis</i>               | White-striped Freetail-bat      | X         |          |
| <b>VESPERTILIONIDAE</b>                   |                                 |           |          |
| <i>Nyctophilus timoriensis</i>            | Greater Long-eared Bat          | X         |          |
| <i>Vespadelus regulus</i>                 | <b>Southern Forest Bat</b>      | X         |          |
| <b>Total number of species per survey</b> |                                 | <b>12</b> | <b>8</b> |
| <b>Total number of species</b>            |                                 | <b>14</b> |          |
| <b>AMPHIBIANS</b>                         |                                 |           |          |
| <b>MYOBATRACHIDAE</b>                     |                                 |           |          |
| <i>Crinia georgiana</i>                   | Quacking Frog                   | X         | X        |
| <i>Crinia glauerti</i>                    | Glauert's Froglet               |           | X        |
| <i>Crinia pseudinsignifera</i>            | Bleating Froglet                | X         | X        |
| <i>Heleioporus albopunctatus</i>          | Western Spotted Frog            | X         |          |
| <i>Heleioporus barycragus</i>             | Hooting Frog                    | X         |          |
| <i>Heleioporus eyrei</i>                  | Moaning Frog                    | X         |          |
| <i>Heleioporus inornatus</i>              | Whooping Frog                   | X         | X        |
| <i>Heleioporus psammophilus</i>           | Sand Frog                       | X         |          |
| <i>Heleioporus sp.</i>                    | Unidentified <i>Heleioporus</i> | X         | X        |
| <i>Limnodynastes dorsalis</i>             | Banjo Frog                      | X         | X        |
| <i>Neobatrachus pelobatoides</i>          | Shoemaker Frog                  | X         |          |
| <i>Pseudophryne guentheri</i>             | Guenther's Toadlet              | X         | X        |
| <b>HYLIDAE</b>                            |                                 |           |          |
| <i>Litoria adelaidensis</i>               | Slender Tree Frog               | X         | X        |
| <i>Litoria moorei</i>                     | Western Bell (Motorbike) Frog   | X         |          |
| <b>Total number of species per survey</b> |                                 | <b>13</b> | <b>8</b> |
| <b>Total number of species</b>            |                                 | <b>14</b> |          |
| <b>REPTILES</b>                           |                                 |           |          |
| <b>GEKKONIDAE</b>                         |                                 |           |          |
| <i>Christinus marmoratus</i>              |                                 | X         |          |
| <i>Diplodactylus polyophthalmus</i>       |                                 | X         | X        |
| <i>Oedura reticulata</i>                  |                                 | X         |          |
| <i>Underwoodisaurus milii</i>             |                                 | X         |          |
| <b>PYGOPODIDAE</b>                        |                                 |           |          |
| <i>Aprasia pulchella</i>                  |                                 |           | X        |
| <i>Delma f. fraseri</i>                   | Fraser's Legless Lizard         | X         | X        |
| <i>Lialis burtonis</i>                    | Burton's Legless Lizard         | X         |          |
| <b>AGAMIDAE</b>                           |                                 |           |          |
| <i>Pogona m. minor</i>                    | Western Bearded Dragon          | X         | X        |
| <b>SKINCIDAE</b>                          |                                 |           |          |
| <i>Acritoscincus trilineatum</i>          |                                 | X         | X        |
| <i>Cryptoblepharus plagiocephalus</i>     | Fence Skink                     | X         | X        |
| <i>Ctenotus delli</i>                     | Dell's Skink                    | X         | X        |
| <i>Egernia napoleonis</i>                 |                                 | X         | X        |
| <i>Hemiergis i. initialis</i>             |                                 | X         | X        |

| SAMPLING YEAR                             |                     | 1984      | 2001-2    |
|---|---------------------|-----------|-----------|
| <i>Lerista distinguenda</i>               |                     | X         | X         |
| <i>Menetia greyii</i>                     | Common Dwarf Skink  | X         | X         |
| <i>Morethia obscura</i>                   |                     | X         | X         |
| <i>Tiliqua r. rugosa</i>                  | Bobtail             | X         | X         |
| <b>VARANIDAE</b>                          |                     |           |           |
| <i>Varanus rosenbergi</i>                 | Rosenberg's Goanna  | X         | X         |
| <b>TYPHLOPIDAE</b>                        |                     |           |           |
| <i>Ramphotyphlops australis</i>           |                     | X         | X         |
| <b>BOIDAE</b>                             |                     |           |           |
| <i>Morelia spilota imbricata</i>          | Carpet Python       | X         |           |
| <b>ELAPIDAE</b>                           |                     |           |           |
| <i>Pseudonaja a. affinis</i>              | Dugite              |           | X         |
| <i>Parasuta gouldii</i>                   |                     | X         |           |
| <b>Total number of species per survey</b> |                     | <b>20</b> | <b>16</b> |
| <b>Total number of species</b>            |                     | <b>22</b> |           |
| <b>INTRODUCED ANIMALS</b>                 |                     |           |           |
| <b>BIRDS</b>                              |                     |           |           |
| <b>HALCYONIDAE</b>                        |                     |           |           |
| <i>Dacelo novaeguineae</i>                | Laughing Kookaburra | X         | X         |
| <b>MAMMALS</b>                            |                     |           |           |
| <b>MURIDAE</b>                            |                     |           |           |
| <i>Mus musculus</i>                       | House Mouse         | X         | X         |
| <b>LEPORIDAE</b>                          |                     |           |           |
| <i>Oryctolagus cuniculus</i>              | Rabbit              |           | X         |
| <b>CANIDAE</b>                            |                     |           |           |
| <i>Vulpes vulpes</i>                      | Red Fox             | X         | X         |
| <b>FELIDAE</b>                            |                     |           |           |
| <i>Felis catus</i>                        | Feral Cat           |           | X         |
| <b>SUIDAE</b>                             |                     |           |           |
| <i>Sus scrofa</i>                         | Feral Pig           | X         | X         |
| <b>Total number of species per survey</b> |                     | <b>4</b>  | <b>6</b>  |
| <b>Total number of species</b>            |                     | <b>6</b>  |           |