Tronox Annual Progress Report - 2014

Fauna Investigations at Cooljarloo: North Mine, Falcon Mine and Dump One

Echidna (*Tachyglossus aculeatus*) captured in a pitfall trap at Falcon South. (Photo: C. Everard).

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1 Introduction

1.1 Background

The aim of this annual progress report is to provide an overview of fauna monitoring conducted at Tronox's Cooljarloo minesite in 2014 by Bamford Consulting Ecologists (BCE). A summary of the studies undertaken in 2014 (including a brief description of methods, survey effort, aims and locations) is presented in Section 2. A discussion of the key results and observations follows in Section 3.

2 Summary of studies

Fauna monitoring at Cooljarloo consists of a range of studies. While these studies may vary in aims, method and geographic location, there are two overarching reasons for monitoring:

(i) to collect baseline ('control') fauna data in areas unimpacted by mining operations; and

(ii) to document the return of fauna to areas that have been disturbed by mining operations and are undergoing rehabilitation.

Some of the studies are conducted on a biennial basis. Those for which sampling was undertaken in 2014 are described in Section 2.1. The remaining studies (for which 2014 was not a scheduled sampling year) are described in Sections **Error! Reference source not found.** and 2.3.

2.1 Ongoing studies with sampling undertaken in 2014

2.1.1 Before-After-Control-Impact (BACI) monitoring

These are sites where fauna sampling has been conducted before and after mining operations in control (i.e. not directly affected by mining activity) and impact (i.e. directly affected by mining activity) areas. At all of these sites, monitoring has been conducted along transects that were positioned across the mine path, with part of the transect (the impact area) removed during the mining process. Rehabilitation of the impact area was initiated immediately after mining activity was complete.

Aims: The aims of the BACI monitoring are to compare the fauna (e.g. diversity, abundance, community composition) of the control and impact areas to document (i) the initial impact of mining and (ii) the rehabilitation process.

Locations: BACI monitoring has been conducted at two locations (North Mine and Falcon), with two replicate transects (sites) at each. The North Mine sites are sampled annually while the sampling programme at the Falcon sites is a biennial one and 2014 was a survey year for these sites. The replicate transects in the North Mine Area are:

- **North Transect**
- **South Transect**

The replicate transects in the Falcon Area are:

- **Falcon North**
- **Falcon South**

Methods and sampling regime: Monitoring at these sites comprised pitfall trapping and bird sampling, with additional bird mist-netting studies (capture-mark-recapture) conducted at Falcon South in some surveys. Survey effort and sampling regimes are presented for these sites in Table 1 and Table 2. All monitoring was suspended at the Falcon sites during impact years, whereas monitoring of control areas at the North Mine sites continued throughout the impact period (excluding active mine areas).

2.1.2 Post-mining Control-Impact (CI) monitoring

These are sites where fauna sampling has been conducted after mining operations have been completed (but not before) in control (i.e. not directly affected by mining activity) and impact (i.e. directly affected by mining activity) areas. At all of these sites monitoring has been conducted along

multiple transects that were stratified in areas either affected or unaffected by mining activity. The sampling areas were all adjacent to one another and three mining impacts ('treatments') were investigated: (i) mining/rehabilitation, (ii) mulch-harvesting and (iii) soil-stockpiling.

Aims: The aim of the CI monitoring is to compare the fauna (e.g. diversity, abundance, community composition) of the treatment and control sites to document how fauna are responding/rehabilitating after the three mining impacts.

Locations: CI monitoring has been conducted at one location (Dump One) with four sites (reflecting the three mining treatments and one control treatment):

- **Dump One – Rehabilitation Transects**
- **Dump One – Mulched Transects**
- **Dump One – Soil Stockpile Transects**
- **Dump One – Control Transects**

Methods and sampling regime: Monitoring at these sites comprised pitfall trapping and bird sampling. Survey effort and sampling regimes are presented for these sites in Table 1 and Table 2. The post-mining control-impact monitoring programme was put on hold at the end of 2012 and resumed, in part, in 2014 (with the exclusion of the mulch-harvested treatment site).

2.1.3 Banksia inflorescence monitoring

Many of the fauna species encountered at Cooljarloo are dependent on nectar. Counting of inflorescences ('flowers') of two Banksia species (*Banksia menziesii* and *B. attenuata*) has been conducted to provide an index of ecosystem productivity.

Aims: The aim of the inflorescence monitoring is to provide a measure of nectar resource availability to correlate with fauna data (and potentially assist in the explanation of patterns in fauna occurrence).

Locations: Inflorescence monitoring has been conducted at three locations:

- **Falcon South**
- **North Mine**
- **Dump One**

Methods and sampling regime: At each site, ten plants of each species were marked (with numbered metal tags) and were first surveyed in August and December 2011. All plants were re-surveyed in November 2012, 2013 and 2014, when flowers of *B. menziesii* from the previous winter could be recognised, and developing or current flowers of the summer-flowering *B. attenuata* could also be counted.

2.1.4 Opportunistic short-range endemic (SRE) invertebrate collection

Because of poor dispersal and/or isolation of populations, some invertebrates are considered to be 'short range endemics (SRE)' and, therefore, of conservation significance. Potential SRE invertebrate taxa (e.g. millipedes, slaters, mygalomorph spiders, snails) may occur within the Tronox leases and, where applicable, are collected for formal identification when encountered.

Aims: To detect the presence of SRE invertebrates.

Locations: All sites.

Methods and sampling regime: Voucher specimens of potential SRE invertebrates are opportunistically collected per Western Australian Museum protocols and returned to the museum for formal identification. This is an ongoing process in all surveys.

2.2 Ongoing studies with no sampling undertaken in 2014

2.2.1 Rehabilitation monitoring

These are sites where fauna sampling has been conducted after mining operations have been completed (but not before) and in impact (i.e. directly affected by mining) areas only. No formal pre-mining sampling was conducted at these sites and there are no control (i.e. not directly affected by mining activity) areas specifically affiliated to them (although data from control sites nearby can be validly used for comparison). At these sites monitoring has been conducted along multiple transects within two ages of rehabilitation (rehabilitation commenced in 2006 and 2007).

Aims: The aim of the rehabilitation monitoring is to document changes in the fauna (e.g. diversity, abundance, community composition) through time (post-mining).

Locations: Rehabilitation monitoring has been conducted at one location (North Mine) with two treatments (sites) reflecting the ages of rehabilitation:

- **North Mine - Rehab 2006**
- **North Mine - Rehab 2007**

Methods and sampling regime: Monitoring at these sites comprised pitfall trapping and bird sampling. Survey effort and sampling regimes are presented for these sites in Table 1 and Table 2.

2.2.2 Vegetation assessment at control and rehabilitation sites

Successful recolonisation of fauna into rehabilitated areas is dependent on reinstating native vegetation that has a similar structure, diversity and productivity to its pre-impacted state. Assessments have been conducted to evaluate different vegetation characteristics between the control and rehabilitated sites.

Aims: The aim of the assessment is to provide information on the vegetation characteristics within the fauna monitoring sites. For example, litter density, structure and species richness and abundance of key Banksia species. Vegetation data collected from control sites provides a useful benchmark in which to assess rehabilitated sites and to further explain patterns of fauna occurrence.

Locations: Vegetation assessments have been conducted at four locations:

- **North Mine - North Transect**
- **North Mine - South Transect**
- **North Mine – Rehab 2006**
- **North Mine – Rehab 2007**

Methods and sampling regime: Sites are assessed for litter percentage, presence of key Banksia species and vegetation structure within a 10 metre radius of a pitfall trap. Vegetation assessments have been conducted in November 2010 and 2013.

2.2.3 Bird censussing in control areas

Bird censussing in control areas is conducted to provide bird density estimates over time and the impact of changes (fire and low rainfall) on species composition and abundance. The data also provides a useful comparison with other bird census locations, such as those along monitoring transects in disturbance areas.

Aims: The aims of the census surveys are to establish bird species composition and abundance.

Locations:

- **North mine (Sites 11 and 12).**

Methods and sampling regime: Observers move through a pre-determined area of about 3ha for 20 minutes and record (and count) the bird species present. Bird census surveys have been conducted at Sites 11 and 12 since winter 1989. The two areas were last surveyed in 2010 (Site 12) and 2013 (Site 11) as both areas were cleared for mining. The censussing program can be reinstated during rehabilitation.

2.3 Studies on hold

2.3.1 Critical Weight Range (CWR) mammal monitoring

The Cooljarloo area has been baited for Foxes since the late 1990s and this may affect the abundance of medium-sized mammals that are not generally caught in pitfall traps. Therefore, sampling using cage and Elliott traps was initiated, with sites consisting of transects with traps located along the edge of tracks. These transects generally pass through areas unaffected by mining.

Aims: The aim of the CWR mammal monitoring is to determine whether fox-baiting affects the abundance and/or diversity of medium sized (native) mammals in the region.

Locations: CWR mammal monitoring has been conducted at two locations (South Mine and North Mine), with one transects (site) at each:

- **North Mine CWR Transect**
- **South Mine CWR Transect**

Methods and sampling regime: Monitoring at these sites comprised cage and Elliott (box-trap) trapping. Survey effort and sampling regimes were presented by Bancroft and Bamford (2009a).

The CWR mammal monitoring programme was put on hold at the end of 2008.

2.3.2 Targeted Western Ground Parrot surveys

The Western Ground Parrot (*Pezoporus flaviventris*), a species of very high conservation significance, may occur in heathland vegetation within the Tronox leases. Aural surveys have been used in an attempt to detect the presence of this species.

Aims: The aim of the targeted Western Ground Parrot surveys is to detect the presence of this species.

Locations: Targeted aural surveys have been conducted throughout the Tronox leases, in areas of potentially suitable (heathland) habitat since 2007 (e.g. north of Falcon and along Wongonderrah

Road). Surveys for the Western Ground Parrot were conducted in April/May 2013 at Cooljarloo West (345368E, 6600201N) and are further discussed in a stand-alone report (Bamford *et al*. 2013).

Methods and sampling regime: Observers position themselves before dawn or dusk at potentially suitable locations and listen for (distinctive) Western Ground Parrot. Locations and survey timing are generally opportunistic or intermittent.

2.3.3 Environmental Impact Assessment (EIA) monitoring (pre-mining)

Sites where fauna sampling has been conducted prior to environmental approval for mining has been granted. Sites comprise transects located as per the BACI monitoring method (i.e. passing through and outside of areas that are proposed to be mined). Should environmental approval be granted this will enable pre-mining data to be used as part of future BACI analyses.

Aims: The aims of the EIA monitoring are to provide data that will support impact assessment, including: assemblage characteristics (uniqueness, completeness and richness), confirming the presence of species of conservation significance and determining the patterns of biodiversity across the landscape.

Location: EIA monitoring has been conducted at one location:

- **Cooljarloo West**

Methods and sampling regime: Monitoring comprised of pitfall trapping and bird censussing (November 2012 and July 2013), targeted Western Ground Parrot surveys and an assessment of foraging value for the Carnaby's Black-Cockatoo (May 2013). Results from these investigations are provided in Bamford *et al*. (2013). Pitfall traps have not yet been removed, in case further work in this area is required.

2.3.4 Control Area monitoring

Sites where fauna sampling has been conducted in an area where there has been no mining activity (or none is planned). Monitoring has been conducted along transects positioned across the landscape. Vegetation in this area was considered to be different to that encompassed by other control areas (i.e. those in the BACI and CI monitoring).

Aims: The aim of the control area monitoring is to provide baseline data to compare with nearby rehabilitated sites, should it be relevant and required.

Locations: Control area monitoring has been conducted at one location:

- **South Mine**

Methods and sampling regime: Monitoring at this site comprised pitfall trapping and bird sampling. Survey effort and sampling regimes are presented for these sites in Table 1 and Table 2. Survey results are provided in Everard *et al*. (2014). This study is presently 'on hold'.

2.4 Completed studies

Fauna monitoring has been conducted by BCE at Cooljarloo since the late 1980s. Several studies have been completed (or terminated) in that time. These include:

- Pre-mining studies at areas such as the 'Access Track Transect' and the 'Vertebrate Grids';
- Rehabilitation monitoring at 'Mouse Houses';
- Rehabilitation monitoring at 'Dam 7' (Bamford 2003);
- Waterbird surveys at Emu Lakes (Bamford 2003);
- A trial of fauna translocation into rehabilitation areas at Dump 1 (Bamford 2007; Bancroft and Bamford 2009b); and
- A trial of pitfall and drift-fence layout to determine the value and effectiveness of different approaches in the Cooljarloo environment (Bancroft *et al*. 2010).

Table 1. Survey effort and sampling regimes (pitfall trapping) at Cooljarloo sampling sites as at December 2014.

NORTH MINE Sampling Sites

Sampling Site	Trap Layout	Sampling Occasions	Current Schedule	Total Trap-nights	Total Species	Total Captures
North Transect	One line of between 36 and 72 trap/bird census points at c. 25 m intervals (trap numbers varied between years; see main report on this site). Some traps re-established after mining.	Established in 1991. Sampling in winter and spring 1991-1996 and 1999-2014, with additional surveys in summer and autumn 1992, and winter 1999 (47 occasions).	Twice-yearly on an annual basis. Next sampling scheduled for winter 2015.	13495	47	3084 (22.8 per 100 trap nights)
South Transect	One line of between 29 and 70 trap/bird census points at c. 25 m intervals (trap numbers varied between years; see main report on this site). Some traps re-established after mining.	Established in 1991. Sampling in winter and spring 1991-1996 and 1999-2014, with additional surveys in autumn 1991, summer and autumn 1992, and winter 1999 (48 occasions).		11070	41	2291 (20.7 per 100 trap nights)
North Mine Rehab 2006	Five lines of 10 trap/bird census points at c. 25 m intervals.	Established in 2009. Sampling in winter and spring 2009, 2011 and 2013 (6 occasions).	Twice-yearly on a biennial basis. Next sampling scheduled for winter 2015.	1500	14	142 (9.5 per 100 trap nights)
North Mine Rehab 2007	Five lines of 10 trap/bird census points at c. 25 m intervals.			1500	13	149 (9.9 per 100 trap nights)

SOUTH MINE Sampling Sites

Sampling Site	Trap Layout	Sampling Occasions	Current Schedule	Total Trap-nights	Total Species	Total Captures
South Mine	One line of 42 trap/bird census points and one line 38 trap/bird census points (80 total); all at c. 25 m intervals.	Established in 2011. Sampling in spring 2011 (part), and winter and spring 2012 and 2013 (5 occasions).	No further sampling scheduled.	1865	22	443 (23.8 per 100 trap nights)

FALCON Sampling Sites

Sampling Site	Trap Layout	Sampling Occasions	Current Schedule	Total Trap-nights	Total Species	Total Captures
Falcon North Transect	One line of 50 trap/bird census points at c. 25 m intervals. 33 traps re-established after mining.	Established in 2007. Sampling in winter and spring 2007, 2008, 2011, 2012 and 2014 (10 occasions).	Twice-yearly on a biennial basis. Next sampling scheduled for winter 2016.	2500	26	582 (23.4 per 100 trap nights)
Falcon South Transect	One line of 50 trap/bird census points at c. 25 m intervals. 11 traps re-established after mining.	Established in 2007. Sampling in winter and spring 2007, 2008, 2009, 2012 and 2014 (10 occasions).		2500	32	613 (24.5 per 100 trap nights)

DUMP ONE Sampling Sites

Sampling Site	Trap Layout	Sampling Occasions	Current Schedule	Total Trap-nights	Total Species	Total Captures
Rehabilitation Transects	Four lines of 20 trap/bird census points at c. 25 m intervals.	Established in 2004. Sampling in spring 2004, and winter and spring 2005-2008, 2010, 2012 and 2014 (15 occasions).	No further sampling scheduled.	6000	26	1054 (17.6 per 100 trap nights)
Mulched Transects	Four lines of 15 trap/bird census points at c. 25 m intervals.	Established in 2004. Sampling in spring 2004, and winter and spring 2005-2008, 2010 and 2012 and 2014 (13 occasions).		3900	38	760 (19.5 per 100 trap nights)
Soil Stockpile Transects	Four lines of 2 trap/bird census points at c. 25 m intervals.	Established in 2004. Sampling in spring 2004, and winter and spring 2005-2008, 2010 and 2012 and 2014 (13 occasions).		520	13	85 (16.3 per 100 trap nights)
Control Transects	Four lines of 20 trap/bird census points at c. 25 m intervals.	Established in 2006. Sampling in spring 2006, and winter and spring 2007, 2008, 2010, 2012 and 2014 (11 occasions).		4395	31	949 (21.5 per 100 trap nights)

COOLJARLOO WEST Sampling Sites

Sampling Site	Trap Layout	Sampling Occasions	Current Schedule	Total Trap-nights	Total Species	Total Captures
Cooljarloo West	Two lines of 72 trap/bird census points at c. 25 m intervals.	Established in 2012. Sampling in spring 2012 and winter 2013 (2 occasions).	No further sampling scheduled.	1440	24	327 (22.7 per 100 trap nights)

Table 2. Survey effort (bird surveys) at Cooljarloo sampling sites as at December 2014.

Sampling Site	Surveys in Which Bird Sampling Conducted	Total Point Counts	Total Species	Total Birds
North Transect	15	4110	47	897 (21.8 per 100 point counts)
South Transect	15	2710	40	830 (30.6 per 100 point counts)
North Mine Rehab 2006	6	1500	19	131 (8.7 per 100 point counts)
North Mine Rehab 2007	6	1500	16	86 (5.7 per 100 point counts)
South Mine	5	1865	35	999 (53.6 per 100 point counts)
Falcon North Transect	10	2500	51	753 (30.1 per 100 point counts)
Falcon South Transect	10	2500	46	896 (35.8 per 100 point counts)
Dump One - Rehabilitation	10	4000	54	973 (24.3 per 100 point counts)
Dump One - Mulched	8	2400	35	650 (27.1 per 100 point counts)
Dump One - Soil Stockpile	8	320	19	92 (28.8 per 100 point counts)
Dump One - Control	10	3995	31	1109 (32.6 per 100 point counts)
Cooljarloo West	2	1440	34	451 (31.3 per 100 point counts)

2.5 Location of sampling sites

An overview map showing fauna monitoring sites is presented in Figure 1.

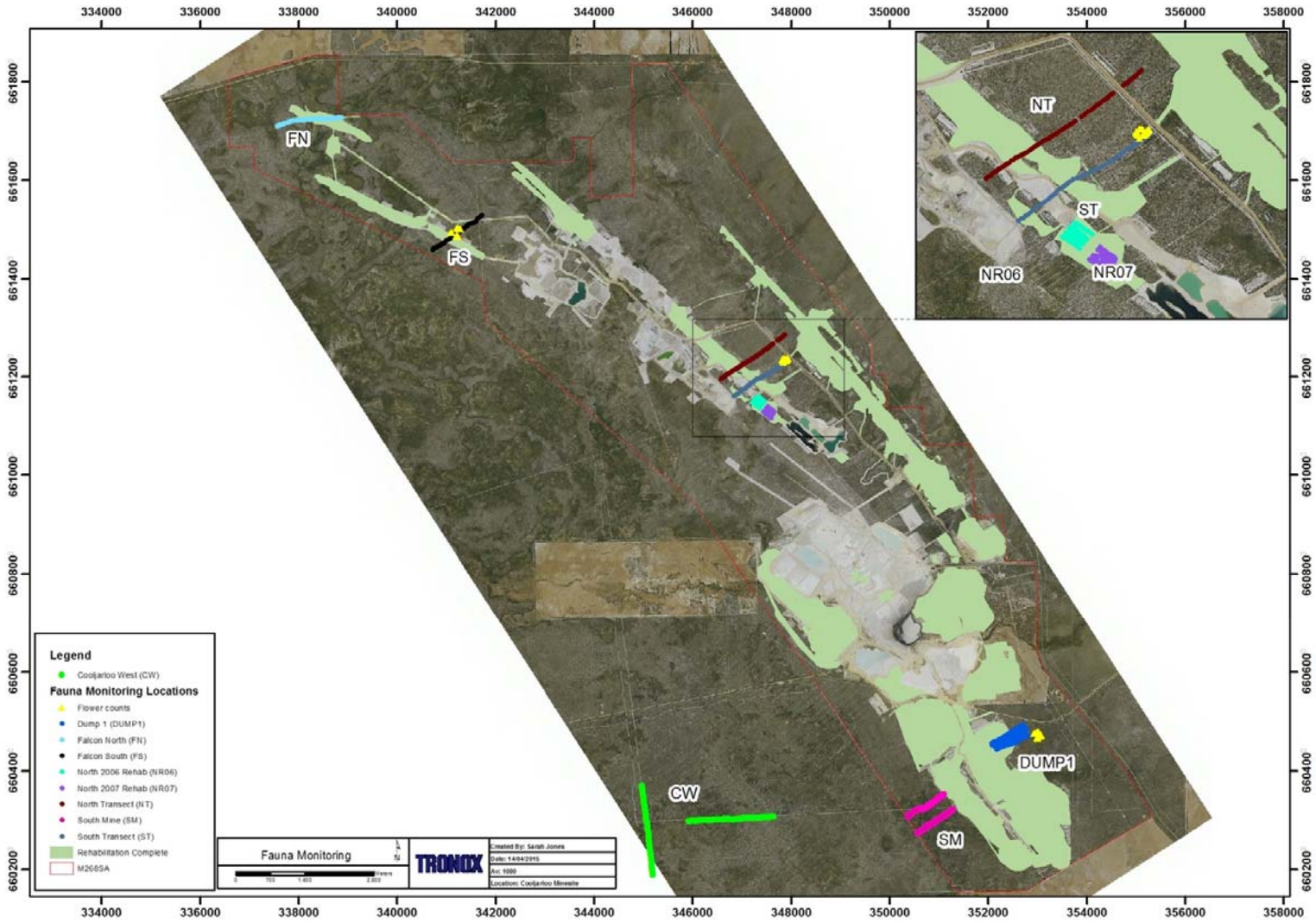
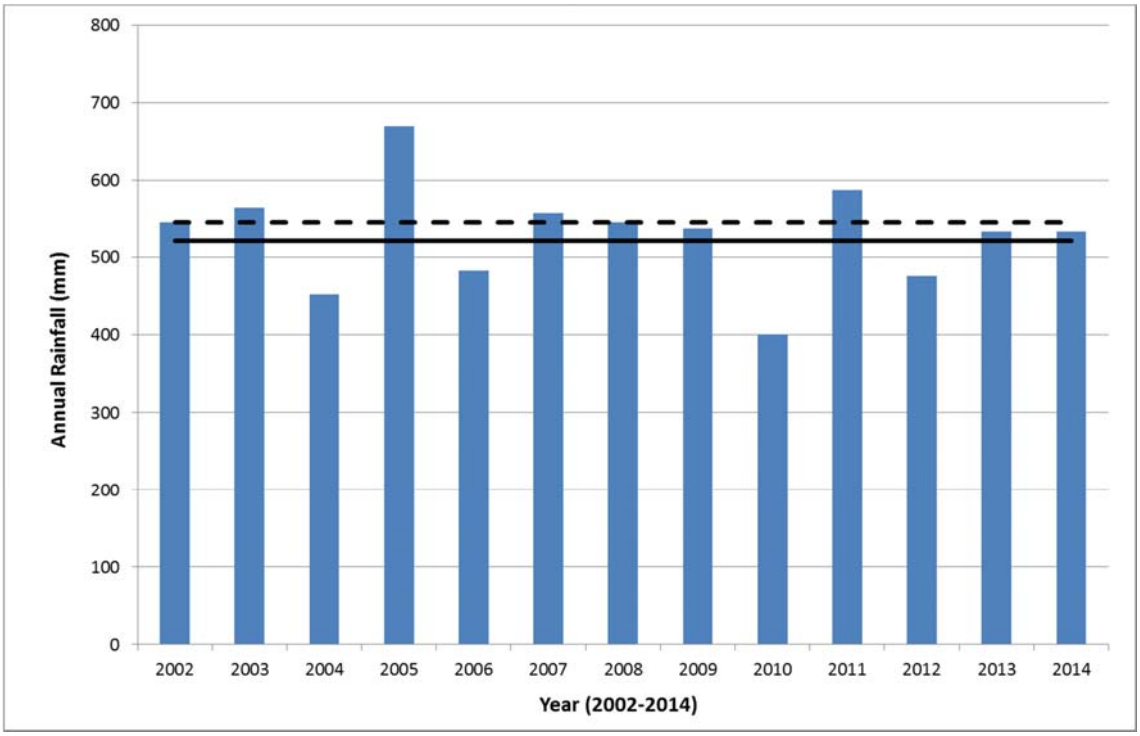


Figure 1. Locations of fauna monitoring sites at Cooljarloo.

2.6 Rainfall

Annual rainfall records at Cooljarloo for the period 2002 to 2014 are provided in Figure 2. A total of 534.8 mm was recorded in 2014 and was slightly above the 20 year site average of 522.7 mm.



Black line: 20 year site average (522.7mm). Black dashed line: Regional average (545.9mm). Data sourced from Tronox site personnel.

Year	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Total mm	546.3	565.6	452.6	670	482.8	558.2	546.4	538.2	400.6	588.4	475.8	534.6	534.8

Figure 2. Annual rainfall at Cooljarloo for the period 2002 – 2014.

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3 Results from studies conducted in 2014

3.1 Before-After-Control-Impact (BACI) monitoring [Falcon North, Falcon South, North Mine North Transect and North Mine South Transect]

3.1.1 Overview

A summary of the before, after, control and impact survey effort is presented in Table 3.

Table 3. Survey effort before and after mining (i.e. the impact) at control and impact (i.e. rehabilitated) areas at the Falcon and North Mine sites.

Site	Survey type	'Before' surveys	Impact Years	'After' surveys	'Control' trap-points	'Impact' trap-points
Falcon North	Pitfall trapping	4 (2007-2008)	2009-2010	6 (2011-2014)	17	33
	Bird censussing	4 (2007-2008)		6 (2011-2014)		
Falcon South	Pitfall trapping	6 (2007-2009)	2010-2011	4 (2012-2014)	39	11
	Bird censussing	6 (2007-2009)		4 (2012-2014)		
North Mine – North Transect	Pitfall trapping	28 (1991-2005)	2005-2010	Control: 19 (2005-2014) Impact: 8 (2011-2014)	43	25
	Bird censussing	-		Control: 13 (2007-2014) Impact: 8 (2011-2014)		
North Mine – South Transect	Pitfall trapping	29 (1991-2005)	2005-2009	Control: 19 (2005-2014) Impact: 8 (2010-2014)	30	9
	Bird censussing	-		Control: 13 (2007-2014) Impact: 9 (2010-2014)		

The total numbers of pitfall captures of each species recorded from the four sites are presented in Appendix 1. The total counts of each bird species recorded at each site are presented in **Error! Reference source not found.**.

3.1.2 Assemblage of frogs, reptiles and small mammals at Falcon North and Falcon South Transects

Falcon is located approximately 5 km north of the North Transect (North Mine) (Figure 1). The area is characterised by broad, flat depressions with seasonally damp clayey soils and Banksia woodland on low sandy rises between the flats. Fauna sampling at these sites commenced in 2007. Since then, 26 species (5 frog, 16 reptile and 5 mammal species) and 582 captures from 2500 trap-nights (23.4 captures per 100 trap-nights) have been recorded at Falcon North. Sampling at Falcon South recorded 32 species (4 frog, 21 reptile and 7 mammal species) and 613 captures from 2500 trap-nights (24.5 captures per 100 trap-nights) (Table 1 and Appendix 1). Fauna monitoring locations at Falcon North and Falcon South are provided in Figure 3.

As with other monitoring sites at Cooljarloo, commonly caught reptile species include the Western Heath Dragon (*Ctenophorus adelaidensis*), Western Bearded Dragon (*Pogona minor*) and West Coast Four-toed Lerista (*L. elegans*). Common mammal species include the Honey Possum (*Tarsipes rostratus*), Noodji or Ash-grey Mouse (*Pseudomys albocinereus)* and the House Mouse (*Mus musculus*). Four conservation significant reptile species have been recorded at Falcon: the Bold-striped Four-toed Lerista (*L. christinae*), Jewelled Ctenotus (*Ctenotus gemmula*), Spotted Stone Gecko (*Diplodactylus polyopthalmus*) and Black-striped Snake (*Neelaps calonotos*).

Reptile captures at Falcon are generally much higher in late spring than in winter, and are higher if warm weather is experienced during the late spring survey than if conditions are cool. There are also effects from weather conditions and fires over longer time periods. Low numbers of captures of the Honey Possum and the House Mouse usually correspond with poor flowering of Banksias. The number of captures of these two species at Falcon North increased between 2011 and 2012, but decreased again in 2014 (Table 4).

Bearded Dragon captures at Falcon North remain low in 2014 (3 captures) compared to pre-mining levels in 2007 (9 captures). The Moaning Frog (*Heleioporus eyrei*), Sand Frog (*H. psammophilus*) and West Coast Four-toed Lerista followed a similar trend. Numbers of the Western Heath Dragon have slowly increased between 2011 and 2014 since the cessation of mining in 2010 (Table 4).

Table 4. Pitfall captures at Falcon North in 2007, 2008, 2011, 2012 and 2014 (winter and spring results pooled).

Species		2007	2008	2011	2012	2014	Total
Moaning Frog	*Heleioporus eyrei*	42	5	4	1	3	55
Sand Frog	*Heleioporus psammophilus*	24		5	3		32
Günther's Toadlet	*Pseudophryne guentheri*	6	1	1	15		23
Western Heath Dragon	*Ctenophorus adelaidensis*	28	14	3	6	24	75
Western Bearded Dragon	*Pogona minor*	9	7	3	1	3	23
West Coast Ctenotus	*Ctenotus fallens*	7	4	2		2	15
West Coast Four-toed Lerista	*Lerista elegans*	21	1	3	2	4	31
Fat-tailed Dunnart	*Sminthopsis crassicaudata*					2	2
Grey-bellied Dunnart	*Sminthopsis griseoventer*	1					1
Honey Possum	*Tarsipes rostratus*	4	10	2	28	13	57
House Mouse	*Mus musculus*	7	60	14	40	18	139
Ash-grey Mouse	*Pseudomys albocinereus*	31	49			5	85

Note: not all species recorded during pitfall trapping surveys are listed, see Appendix 1 for complete list.

Bird assemblage at Falcon North and Falcon South Transects

Bird censussing at Falcon North and South transects has been conducted since 2007 (10 occasions). A total of 51 bird species and 753 observations from 2500 point counts (30.1 birds per 100 point-counts) were recorded at Falcon North. At Falcon South, 46 bird species and 896 observations from 2500 point counts (35.8 birds per 100 point-counts) were recorded (Table 2 and Appendix 2). One hundred and fifty-three bird species are expected to occur in the Cooljarloo area according to database searches (DPaW 2013, Birds Australia 2013); up to 2014, 61 species (40%) had been recorded. Many of these are vagrants.

Common birds at Falcon include several honeyeater species such as the Brown, White-cheeked and Tawny-crowned Honeyeaters. These nectarivores are the most abundant species and make up 752 (46%) of the 1649 bird census records at Falcon North and South Transects (Appendix 2). The Brown-headed Honeyeater has not been recorded at Falcon, but has been recorded at the North Mine transects. The Black Honeyeater is more prevalent at Falcon but is very episodic and is absent in some years.

Other commonly observed species include the Western Thornbill, White-winged Triller, Dusky Woodswallow and Silvereye. Overall the bird assemblage in the Falcon area is similar to that elsewhere in the Cooljarloo area but is notable for the conservation significant Southern Emu-wren, which is seen regularly in the heath on the flats at Falcon and is very infrequent elsewhere. Other conservation significant species recorded at Falcon include the Carnaby's Black-Cockatoo, Rainbow Bee-eater, Rufous Fieldwren and Crested Bellbird (see Appendix 8). The state and federally listed Carnaby's Black-Cockatoo is often recorded in flocks of several hundred, with non-breeding birds regularly seen foraging around the Cooljarloo and Falcon area.

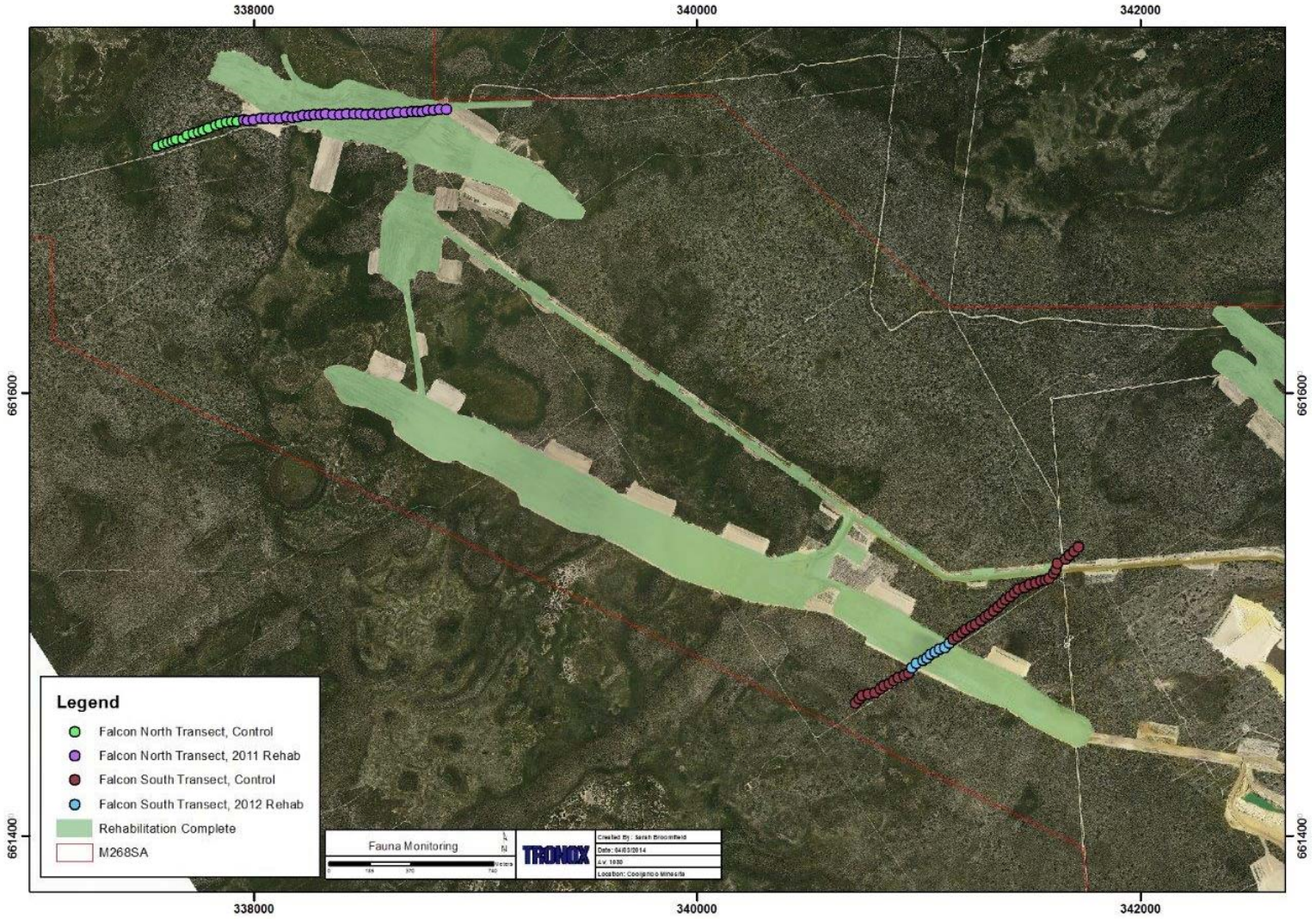


Figure 3. Fauna monitoring locations at Falcon North and Falcon South.

3.1.3 Assemblage of frogs, reptiles and small mammals at North Mine North and South Transects

Fauna sampling at the North and South Transects commenced in 1991. Since then, 47 species (7 frog, 31 reptile and 9 mammal) and 3084 captures from 13495 trap-nights (22.8 captures per 100 trap-nights) have been recorded at North Transect. Sampling at the South Transect recorded 41 species (8 frog, 25 reptile and 8 mammal) and 2291 captures from 11070 trap-nights (20.7 captures per 100 trap-nights) (Table 1 and Appendix 1). Fauna monitoring locations at North Mine North and South Transects are presented in Figures 1 and 4.

As with other fauna monitoring sites, captures of frogs, reptiles and small mammals on the two North Mine transects have varied greatly between seasons and years, largely due to the influence of weather conditions at the time sampling, annual rainfall and fire in 1994 and 2003. Furthermore, mining operations progressed through the western end of the transects between the years 2005-2010 (North transect) and 2005-2009 (South Transect) (Figure 4).

Commonly caught reptile species include the Western Heath Dragon, Western Bearded Dragon and West Coast Ctenotus. The Bearded Dragon was very abundant between the two fires (in 1994 and 2003) but the number of captures has declined during spring surveys on both transects in the last 10 years (see Appendix 3). The Western Heath Dragon recorded a similar trend of increased abundance between fires and declined since 2003 along the South Transect. Interestingly, capture rates for this species remained high during mining operations at the North Transect (see Appendix 3).

Common mammal species include the Honey Possum, Ash-grey Mouse and the House Mouse. A high correlation (r=0.76) was found between Honey Possum captures from 2005 to 2014 (winter/spring and North/South Transects pooled), and previous years rainfall (2004 to 2013). This is discussed further in Section 3.3 and presented in Figure 12.

Fire also influences the abundance of some other species. There have been fires across at least part of the North and South Transects in 1994 and 2003, and the Ash-grey Mouse increased in abundance a few years after both fire events, but had declined by 2014. The Honey Possum, House Mouse and Ashy-grey Mouse make up 2342 of the 5374 (44%) captures at the North and South Transects (Appendix 1). Less common mammals include the four species of Dunnart (*Sminthopsis crassicaudata, S.* aff. *dolichura*, *S. granulipes* and *S. griseoventer*. The number of *S. granulipes* recorded at the North Transect has steadily increased since 2007 and were the highest in 2014 since monitoring began in 1990 (19 captures). A summary of the number of species and captures for frogs, reptiles and mammals at North and South Transects from 1990 to 2014 (23 years) is provided in Appendix 3.

Bird assemblage at North Mine North and South Transects

Bird censussing at pitfall trap locations within the North Mine area has been conducted since spring 2007. Totals of 47 bird species and 897 observations from 4110 point counts (21.8 birds per 100 point-counts) were recorded at the North Transect. At the South Transect, 40 bird species and 830 observations from 2710 point counts (30.6 birds per 100 point-counts) were recorded (Table 2 and Appendix 2). As with Falcon, common birds recorded at the North Mine include several honeyeater

species such as the Singing, Brown, White-cheeked and Tawny-crowned Honeyeaters. These four honeyeaters make up 1047 of the 1727 (61%) bird census records at North and South Transects, with the Brown Honeyeater alone accounting for 33% of records (Appendix 2). Honeyeaters are nectarivore which forages on a range of flowering plants, but focus primarily on several Banksia species present in the area. Other commonly observed species include the Rufous Whistler, White-winged Triller and Black-faced Woodswallow. Five bird species of conservation significance have been recorded in the North mine area: Carnaby's Black-Cockatoo, Rufous Fieldwren, Southern Emu-wren (at north transect), Rainbow Bee-eater (at south transect in spring 2014) and Crested Bellbird (see Appendix 8). A summary of the number of bird observations each year since spring 2007 at North and South Transects is provided in Appendix 4.

Bird censussing has found that numbers are fairly consistent from year to year except due to fire and rainfall. Immediately following fire, nectarivorous birds decline in abundance and remain at low densities for several years. In contrast, insectivorous birds peak in abundance a few years after fire and decline in the absence of fire. The abundance of nectarivorous birds is also low following a year of poor rainfall, as flowering of key nectar-bearing species such as the Banksias is then poor. This is discussed in detail in Section 3.3 and presented in Figure 12. Nectarivorous birds are very mobile so leave the area when flowering is poor, whereas the abundance of insectivorous species displays less of this short-term variation because individuals tend to be sedentary. Despite this, in terms of density the bird assemblage is dominated by nectarivores in all surveys.

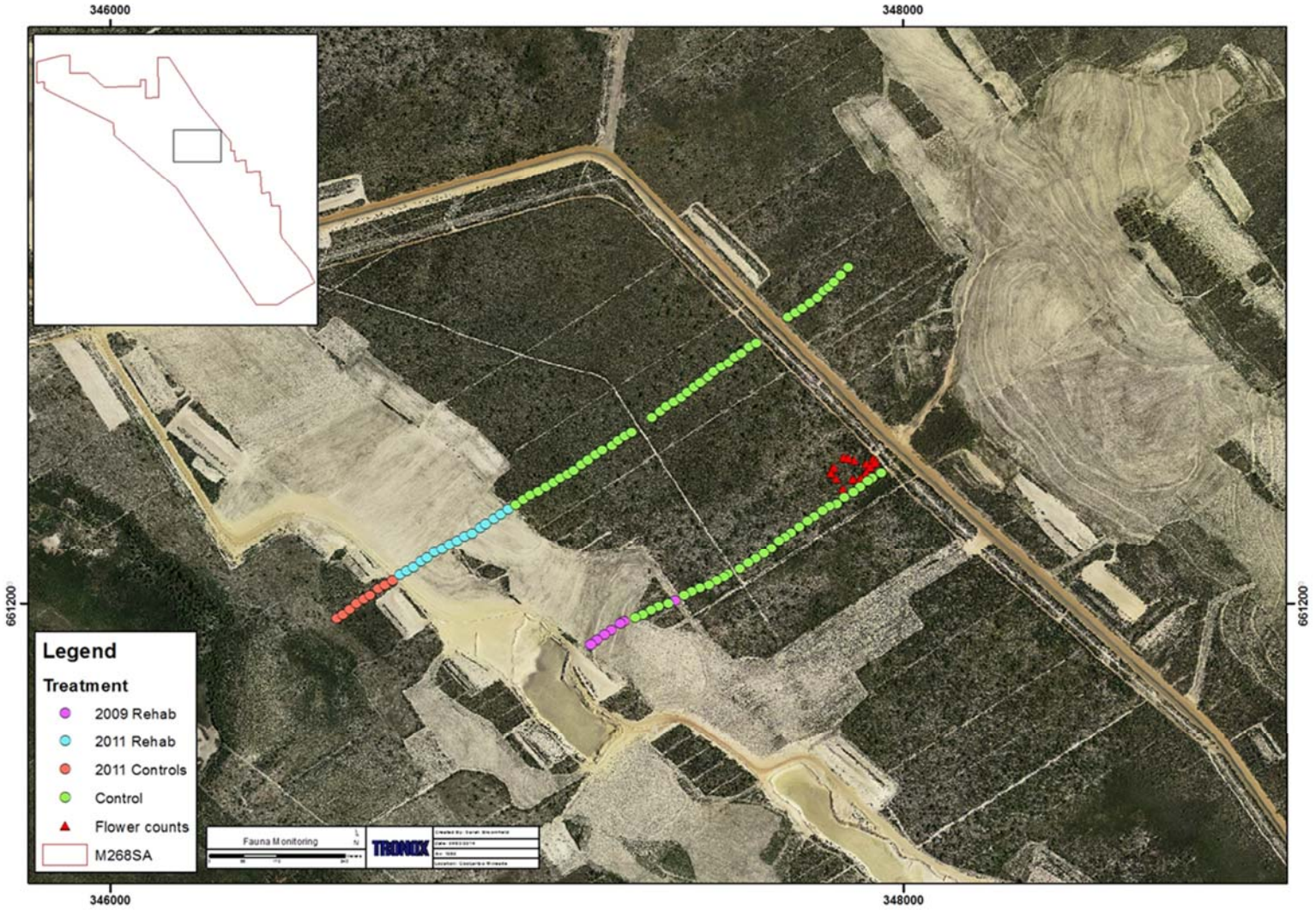


Figure 4. Fauna monitoring locations at North Mine (North and South Transects).

Summary of Falcon and North Mine fauna assemblages

The faunal assemblages of the two areas are similar but not the same. Two conservation significant (CS3) reptile species that are yet to be recorded at North Mine or Dump 1, but are caught regularly at Falcon South, include the Bold-striped Four-toed Lerista and the Spotted Stone Gecko. The gecko is considered locally significant as the species is poorly-known in the region. Several reptile species (including four legless lizard and three skink lizards) that have been recorded at North Mine have not been recorded at Falcon. Total species richness (transect data pooled) is higher at North Mine than Falcon (49 and 36 species respectively), although more sampling has occurred at North Mine. When capture rates are standardised to 100 trap-nights, the rate is slightly higher at Falcon (23.9 captures 100 per trap-nights) compared with North Mine (21.8 captures 100 per trap-nights) (Appendix 1).

Bird species richness at the two sites is comparable although higher at Falcon than North Mine (61 and 50 species respectively), even though less sampling (point-counts at pitfall traps) has occurred at Falcon. Birds per 100 point-counts are higher at Falcon (32.9 records 100 per trap-nights) compared with North Mine (25.3 records 100 per trap-nights) (Appendix 2). Overall, species richness and density tend to be highest on the transition between Low Woodland and scrub-heath or low heath that lies low in the landscape, and particularly where there are riparian elements to the vegetation (e.g. Falcon). The highest species richness and overall density found during bird censussing at Cooljarloo occurs in an area of Riparian Woodland, scrub-heath and adjacent Banksia Low Woodland where typical sandy soils on a slope are juxtaposed with a seasonally inundated flat supporting Low Heath on heavier soils. These observations suggest that the margins of Banksia Woodlands and Low Heaths are important for bird richness and diversity.

3.1.4 Response of fauna to rehabilitation at Falcon and North Mine

The mining process removed all vegetation, topsoil and, hence, fauna from the impact areas along the BACI monitoring transects at Falcon and North Mine (see Table 3 for the number of pitfall traps affected at each site). Following the completion of mining, the topsoil and landscape profile were reinstated, and vegetation was reseeded. Pitfall traps were reinstated and fauna monitoring recommenced as soon as this process was complete.

As an indicator of the return of fauna, the total number of captures (standardised to per 100 trap-nights) is presented for each pitfall for before- and after- the impact period at Falcon North (Figure 5), Falcon South (Figure 6), North Mine North Transect (Figure 7) and North Mine South Transect (Figure 8). For all impact areas, the species capture rates after mining were considerably lower than beforehand (as expected) but, encouragingly, some frog, reptile, mammal and bird species are returning to these areas.

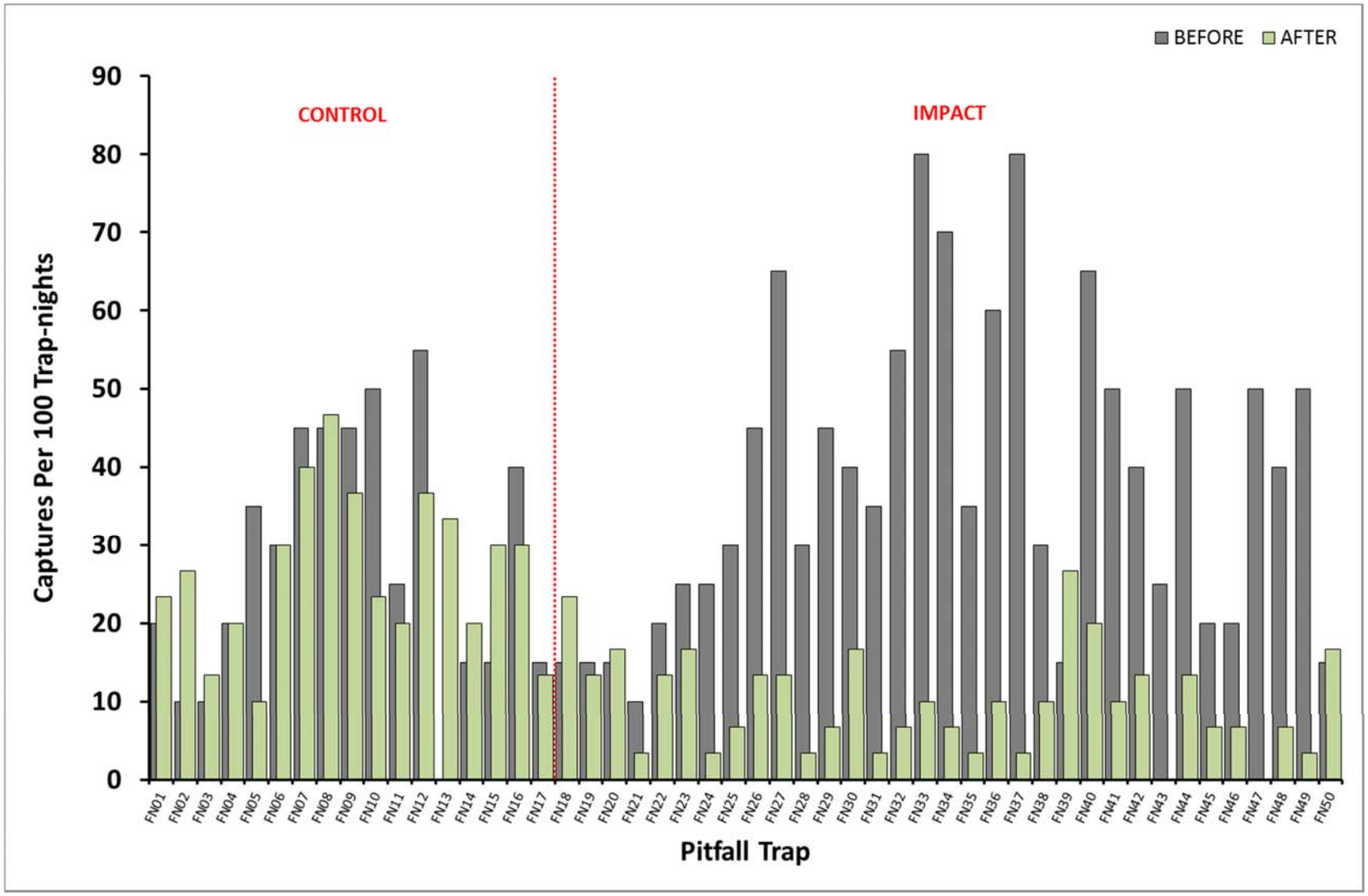


Figure 5. Average pitfall capture rates along the Falcon North transect indicating sampling before and after mining in control and impact areas.

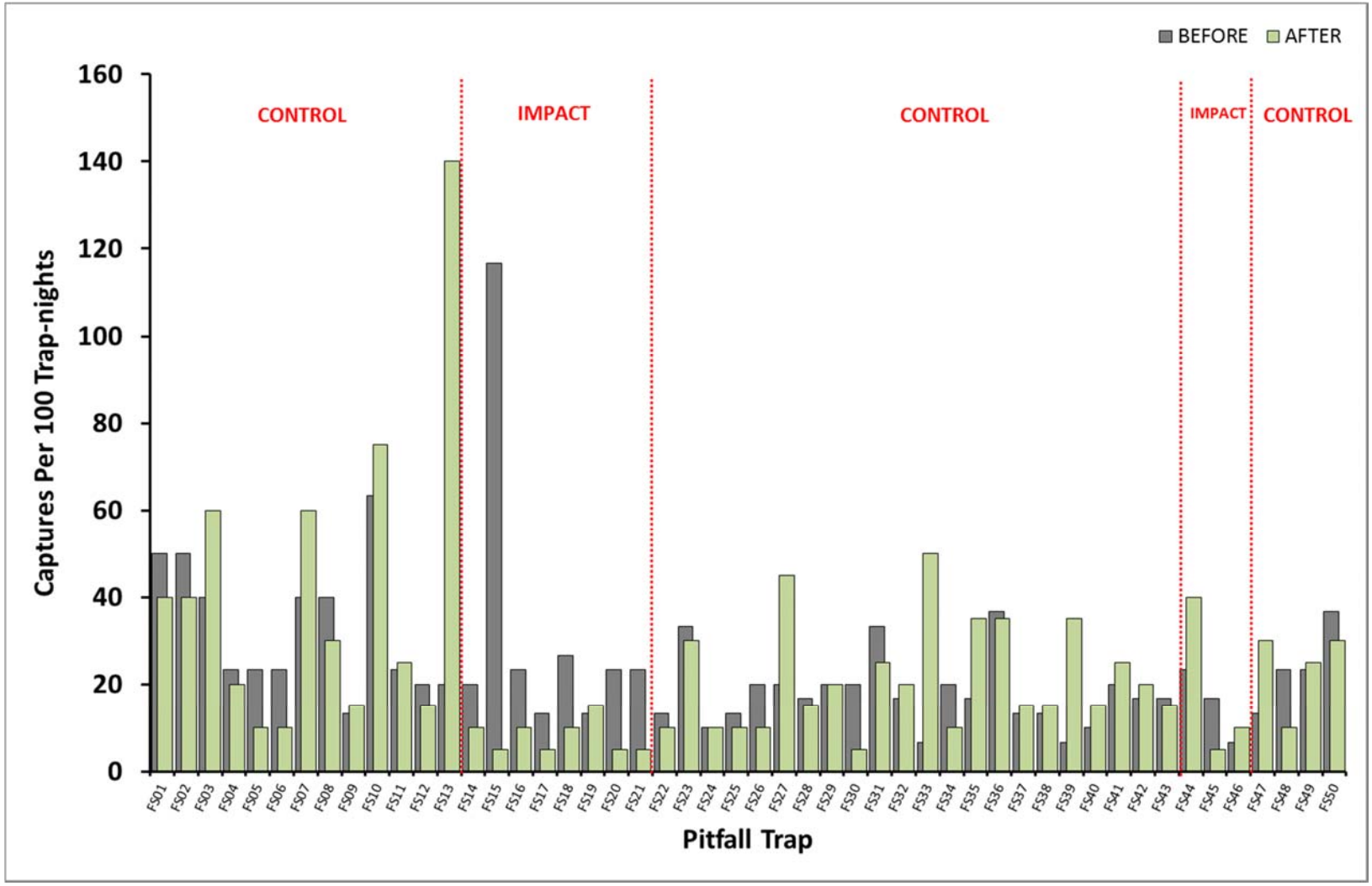


Figure 6. Average pitfall capture rates along the Falcon South transect indicating sampling before and after mining in control and impact areas.

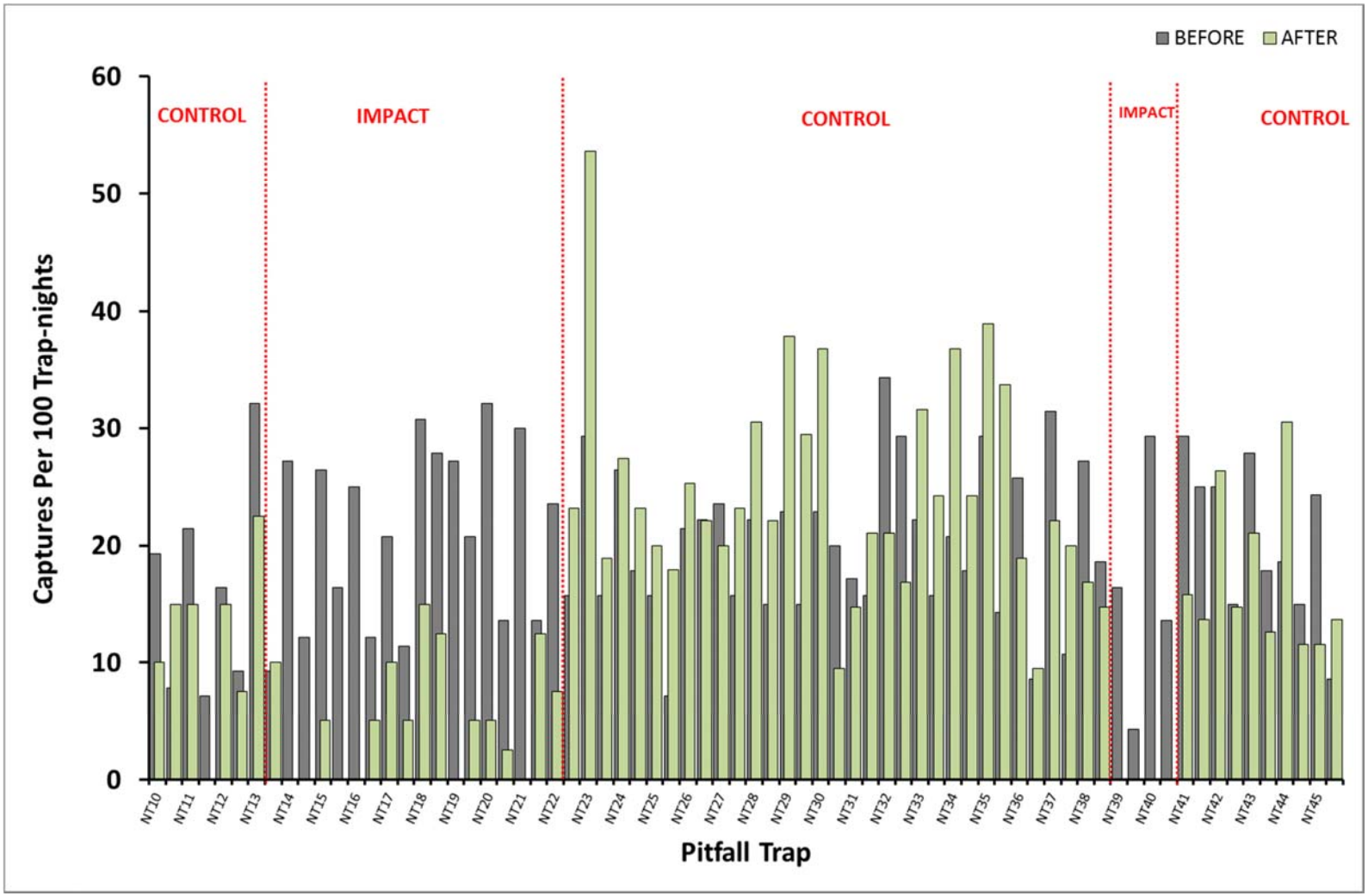


Figure 7. Average pitfall capture rates along the North Transect indicating sampling before and after mining in control and impact areas.

Note: Pitfall traps NT39 to NT40A are currently situated under a haul road and not included in the analysis.

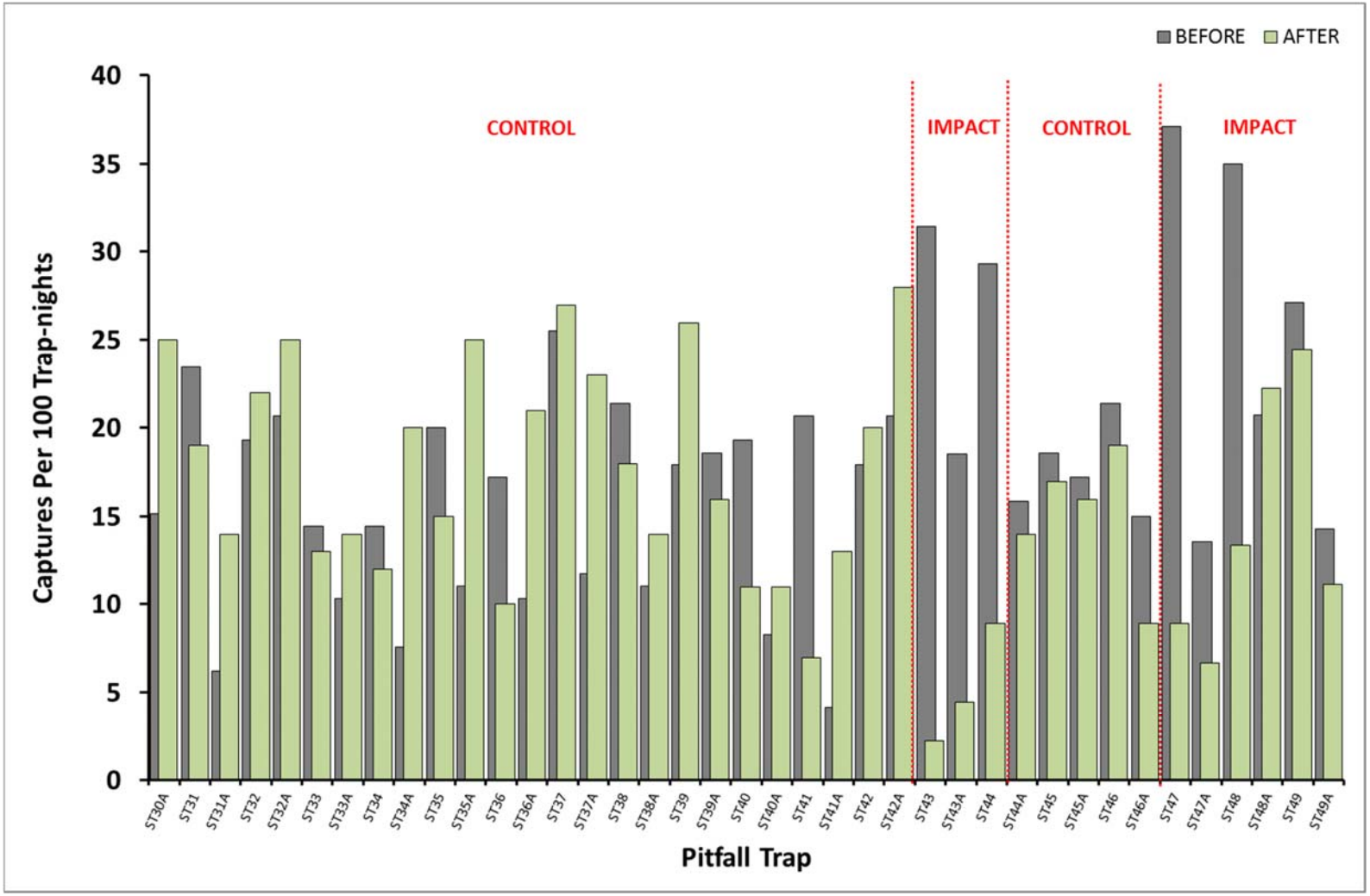


Figure 8. Average pitfall capture rates along the South Transect indicating sampling before and after mining in control and impact areas.

The following analysis compares pitfall captures and bird count data from the rehabilitated areas of Falcon and North Mine North and South transects (pooled) with the control areas, standardised to 100 trap-nights (Tables 4 and 5). Note, not all species recorded in 2014 are listed in the tables. In 2014, 20.3 species was recorded in the rehab of Falcon and North Mine and 17.8 species in the control areas.

A single frog species (the Moaning Frog) was recorded across all rehabilitated areas sampled in 2014, and only two species were recorded in the control areas, the Humming Frog and Moaning Frog. Standardised captures of the Moaning Frog were higher in the rehabilitated area (Table 5). Other positive signs include the return of a number of reptile species to the impacted areas. Eight reptile species were recorded in the rehabilitated and 17 in the control areas. Species include the Western Heath Dragon, Bearded Dragon and several skink species such as the West Coast Ctenotus, Bold-striped Four-toed Lerista and Bobtail (*Tiliqua rugosa*). Of these species, the Western Heath Dragon, Bold-striped Four-toed Lerista and Bobtail recorded higher standardised captures rates in rehabilitated areas.

Mammals are slow to colonise the impacted areas, perhaps due to the lack of vegetation cover and/or increased predation from around the mine path. Mammal species which are commonly caught in the control sites and now reappearing in the rehabilitation areas include the Honey Possum, House Mouse and White-tailed Dunnart. A similar recolonisation trend has been observed with these same species at Dump 1 and North Mine 2006/2007 rehabilitation sites. Standardised captures of the Fat-tailed Dunnart and White-tailed Dunnart were higher in the rehab (Table 5). This may be attributed to a general population increase due to fox control or the absence of fire in the area.

Table 5. Total and standardised captures rates at control and rehabilitation sites (Falcon and North Mine 2014 data pooled).

Species*	Control sites - total captures	Rehab sites - total captures	Control sites - standardised captures**	Rehab sites - standardised captures**
Moaning Frog	1	3	0.07	0.43
Humming Frog	1	0	0.07	0.00
W. Heath Dragon	18	22	1.33	3.19
Bearded Dragon	8	1	0.59	0.14
W.S. Ground Gecko	11	4	0.81	0.58
West Coast Ctenotus	34	1	2.52	0.14
B.S. Four-toed Lerista	0	2	0.00	0.29
W.C. Four-toed Lerista	4	1	0.30	0.14
Dwarf Skink	7	1	0.52	0.14
Bobtail	0	1	0.00	0.14
Fat-tailed Dunnart	0	4	0.00	0.58
White-tailed Dunnart	18	10	1.33	1.45
Honey Possum	27	9	2.00	1.30
House Mouse	53	16	3.93	2.32
Ash-grey Mouse/Noodji	12	5	0.89	0.72

*Scientific names for species are provided in Appendix 1.

** Standardised to captures per 100 trap-nights. Control sites (135 pits) and Rehab sites (69 pits).

Trapping effort: Control sites (1350 trap-nights) and Rehab sites (690 trap-nights).

In 2014, the diversity and abundance of most bird species was generally lower in the rehabilitated areas (11 species) compared with the control areas (30 species). Similarly, when standardised, more species were recorded in the control areas (15.9 and 22.2 species per 100 point-counts respectively). Several species such as the White-winged Fairy-wren, Southern Emu-wren, Grey Butcherbird and Australasian Pipit were more prevalent in the rehabilitated areas in 2014 (Table 6).

The number of nectarivorous birds (e.g. honeyeaters) was lower in the rehab areas (Table 6), most likely due to the lack of nectar-bearing Banksia species. However, it is expected to increase as key flowering species develop over time. Nectarivorous birds are very mobile so normally leave an area when nectar availability is poor. Many bird species were heard calling in the adjacent bushland and are likely to forage in the rehabilitated areas. Notable among the birds that are now seen regularly at other rehabilitation sites are the heathland specialists (e.g. Rufous Field-wren). These species are usually absent from the surrounding woodland and disappear from the rehabilitated area when the vegetation has matured.

Table 6. Total and standardised counts at control and rehabilitation sites (Falcon and North Mine 2014 data pooled).

Species*	Control sites - total counts	Rehab sites - total counts	Control sites - standardised counts**	Rehab sites - standardised counts**
Galah	3	2	0.22	0.29
White-winged Fairy-wren	0	4	0.00	0.58
Variegated Fairy-wren	12	2	0.89	0.29
Southern Emu-wren	0	2	0.00	0.29
Singing Honeyeater	4	1	0.30	0.14
Tawny-crowned Honeyeater	43	8	3.19	1.16
Brown Honeyeater	155	12	11.48	1.74
White-cheeked Honeyeater	73	4	5.41	0.58
Black-faced Woodswallow	12	3	0.89	0.43
Grey Butcherbird	1	1	0.07	0.14
Australasian Pipit	1	8	0.07	1.16

*Scientific names for species are provided in Appendix 2.

** Standardised to observations per 100 point-counts. Control sites (135 point-counts) and Rehab sites (69 point-counts).

It should be highlighted that rehabilitation at some of these sites was completed as recently as 2010 and 2011, thus are still in the very early stages of development and maturation. In comparison, the North Mine 2006 and 2007 rehab sites are now eight and seven years old and provide a good example of what is achievable in terms of mine rehabilitation at Cooljarloo. The data from these two sites clearly shows positive progress towards successful recolonisation of the rehabilitated areas, and in a relatively short period of time. It is expected that this success will be replicated at Falcon and North Mine (North and South Transects).

3.2 Post-mining Control-Impact (CI) monitoring [Dump One Rehabilitation, Dump One Soil Stockpile and Dump One Control]

3.2.1 Overview

The total numbers of pitfall captures of each species recorded from the four CI monitoring sites are presented in Appendix 5. The total counts of each bird species recorded at each site are presented in Appendix 6. Fauna monitoring locations at Dump 1 are given in Figure 9 below. A summary of the number of species and captures for frogs, reptiles and mammals at Dump 1 (rehabilitation, mulched, soil stockpile and control sites) is provided in Table 7.

Table 7. Number of species and captures of frogs, reptiles and mammals at Dump One.

Dump 1 Sites	Frogs		Reptiles		Mammals		Total		
	No. of species	No. of captures	No. of species	No. of captures	No. of species	No. of captures	No. of species	No. of captures	No. of trapnights
Rehab	7	357	14	306	5	391	26	1054	6000
Mulched	8	116	23	343	7	301	38	760	3900
Stockpile	5	17	5	32	3	36	13	85	520
Control	8	118	17	394	6	437	31	949	4395

3.2.2 Response of fauna to rehabilitation, soil stockpiling and mulching

As an index of response following impact, the capture rates (in the pitfall traps) in each year for each of the four sites are shown in Figure 10 (for spring surveys only, when maximum capture rates were achieved). After initial surveys in which captures rates were well below the long-term average from the control (i.e. unimpacted) site, the rehabilitation, mulched and soil stockpile sites had, in 2012, reached or exceeded that long-term control capture rate. In 2014, capture rates between the control and rehab sites were similar (28 and 29 captures respectively) and exceeded the long-term capture rate at the soil stockpile site (Figure 10). No pitfall trapping was conducted at the mulched harvested area in 2014.

The general trend at each of these 'impacted' sites has been an increase, through time, in the pitfall capture rate. While it should be acknowledged that basic capture rate may only be a crude comparative measure (for example, species composition may be different), it does at least demonstrate that the impacted sites are trending towards the 'general' situation observed in the control area. This is encouraging and suggests that the rehabilitation/recovery of the rehabilitation and mulched areas (in particular) is well on the way to being 'successful'.

A similar approach was conducted for bird data for the CI monitoring sites. The bird densities (birds per hectare per survey) in each year for each site are shown in Figure 11. A similar pattern to the trapping data was observed between 2004 and 2012; bird density in the impacted sites had increased through time and by 2012 had approached the long-term density recorded in the control site. However, in 2014 bird densities decreased across all sites. The decline may be due to the increasing height of the rehabilitation and therefore conditions are less favourable for low shrubland specialists. No bird counts were conducted at the mulched harvested area in 2014. Further analyses of these data will be conducted in a separate report: including incorporating all data (i.e. also

comparing winter sampling data) and accounting, concurrently, for the identity of species recorded in impact and control areas (e.g. those in common and those exclusive to one or the other) and the relative (e.g. proportional) abundance of those species. Several metrics may be used for comparison in these analyses including species richness, capture rate/density and diversity indices. Techniques for analysis may include graphical comparison, analysis of variance (ANOVA), similarity indices (e.g. Morisita's index), non-metric multidimensional scaling (nMDS), analysis of similarities (ANOSIM) and similarity percentage (SIMPER).

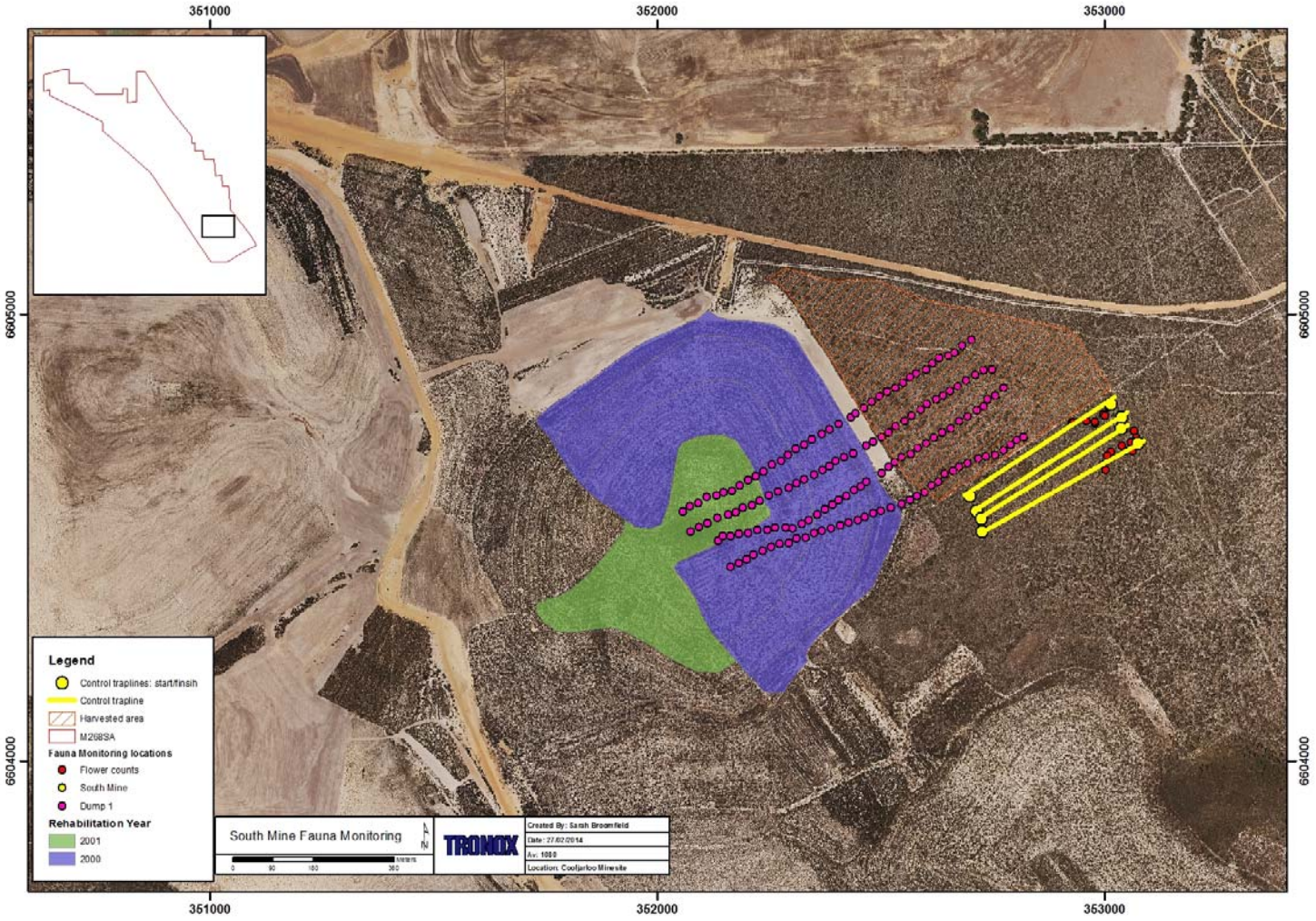


Figure 9. Fauna monitoring locations at Dump One.

Note: No sampling was conducted in the mulch harvested area (red thatch area) in 2014.

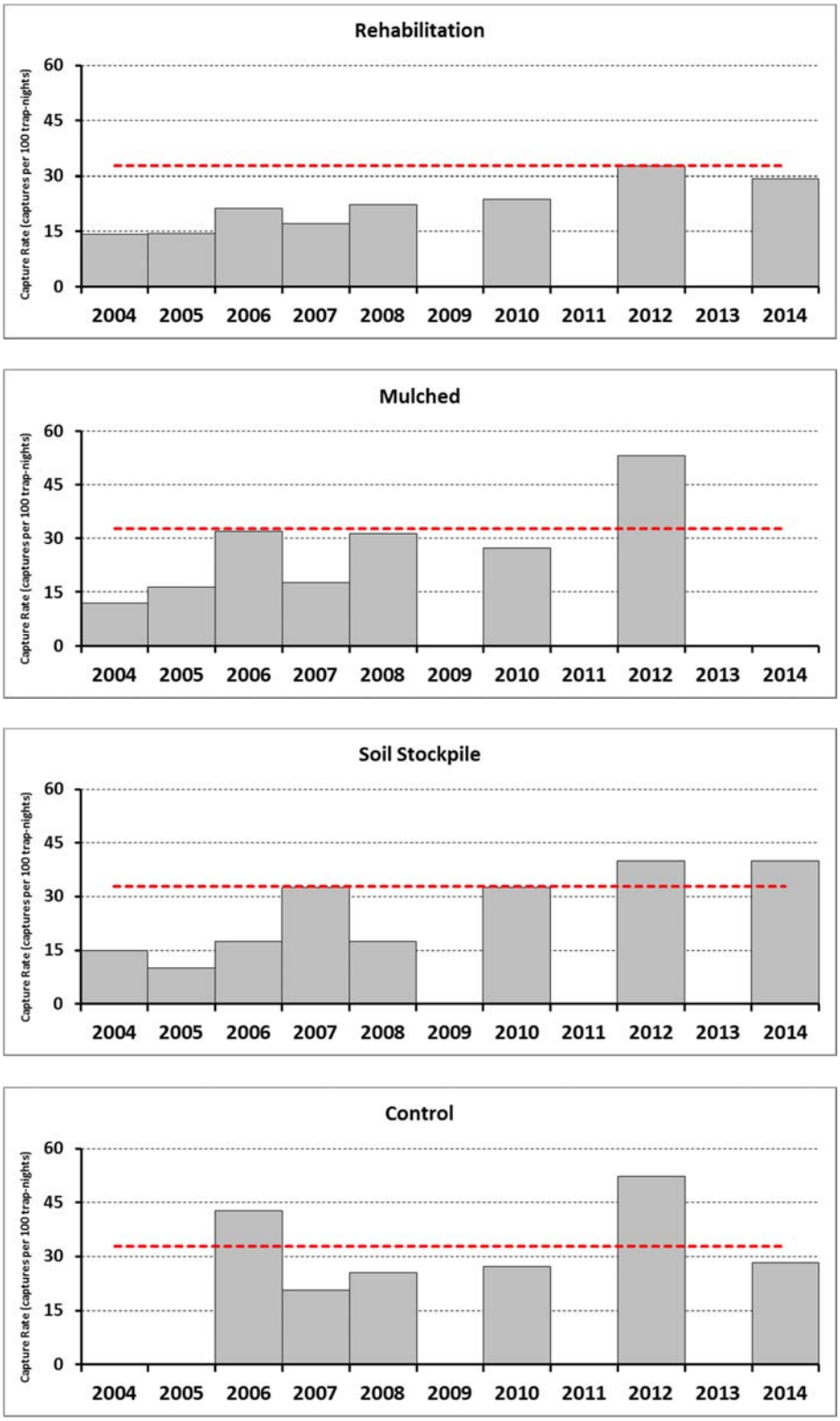


Figure 10. Capture rates (per 100 trap-nights) of fauna at the four treatment sites (Rehabilitation, Mulched, Soil Stockpile and Control) in the spring surveys 2004-2014.
Long-term capture rate in the control site is shown as red dashed line.

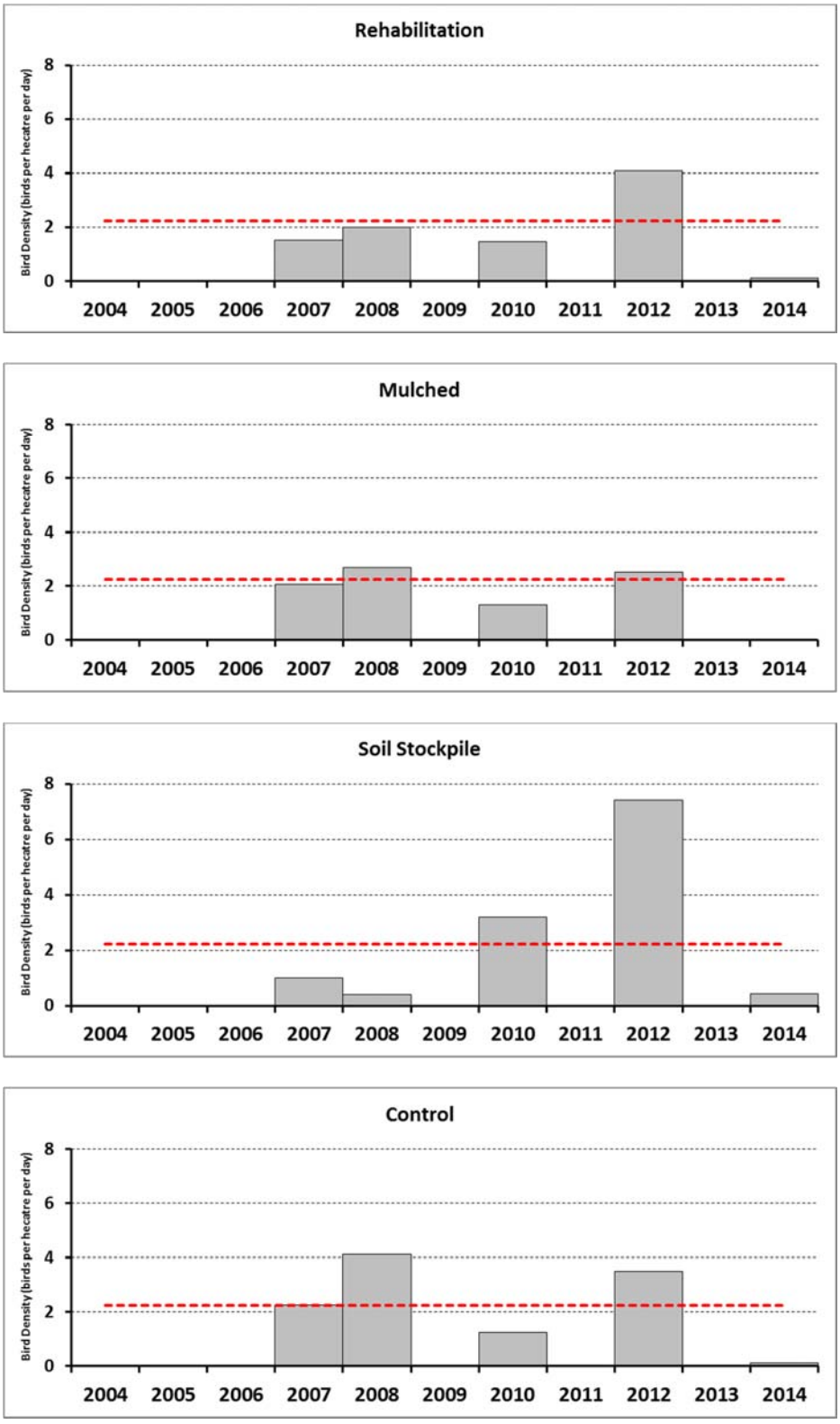


Figure 11. Bird densities (birds per ha per survey day) at the four treatment sites (Rehabilitation, Mulched, Soil Stockpile and Control) in the spring surveys 2004-2014.
Long-term density in the control site is shown as red dashed line.

3.3 Banksia Inflorescence monitoring [Falcon South, North Mine and Dump One]

Two Banksia species (*B. attenuata* and *B. menziesii*) were selected as key indicator species, with the aim to count the flowers (strictly inflorescences) as a measure of nectar production and to provide a useful index for determining ecosystem productivity. Furthermore, monitoring may indicate how productivity influences patterns of species richness and abundance at different locations. Three areas within the Cooljarloo lease area were chosen for the annual counts: Falcon South, North Mine (South Transect) and Dump 1 Rehabilitation site (Figure 1). At each site, ten plants of each species were marked (numbered with metal tags).

Banksia flower counts were initially conducted in August and December 2011. All plants were re-surveyed in November 2012 and July and November 2013. In 2014, counts were conducted in August and (Appendix 7). Note that *B. menziesii* flowers in winter and *B. attenuata* in summer, but the number of flowers in the previous season can be estimated at either time of the year. Mean *B. attenuata* and *B. menziesii* flower counts for the three selected sites between 2010 and 2014 are provided in Tables 8 and 9 respectively. Note 2010 flower counts were identified during the 2011 survey from old flower cones. Annual rainfall from the previous year is also given in the tables.

Estimated flower counts for *B. attenuata* were higher in 2010 when compared to the years 2011 to 2014. Mean *B. attenuata* counts in 2010, 2012 and 2014 recorded 28.4 flowers, 4.1 flowers and 21.6 flowers respectively (Table 8). Counts from 2011 and 2013 identified that poor flowering had occurred in these years.

A similar trend was recorded over the years for *B. menziesii* including a mean count of 11.5 flowers, 5.7 flowers and 6.3 flowers in 2010, 2012 and 2014 respectively (Table 9). There was an increase of *B. menziesii* flowers in 2014 (6.3 flowers), but still lower than 2010. Winter flower counts were low in 2011 and 2013. There was also some variation between the monitoring sites, for example, North Mine and Dump 1 both decreased in *B. menziesii* flowers while Falcon South flower counts increased from 2011.

Overall, the number of flowers correlated positively with previous year's annual rainfall, with varying degrees of strength. Correlation coefficients (*r*) range from a perfectly negative correlation of -1 to no correlation of 0 to a perfectly positive correlation of +1. Low correlation ranges from +/-0.1 to 0.3; medium correlation from +/-0.3 to 0.5; high correlation from +/-0.5 to 1.

When data from all three sites were pooled, a medium to high correlation was found between previous year's rainfall (2009 to 2013) and flowers from 2010 to 2014 (*B.attenuata, r*=0.44) and (*B. menziesii, r*=0.71). However, in 2012 flower counts were reasonably low even after high rainfall from the previous year (2011-588.4mm) (Table 8).

A similar study investigating *Banksia hookeriana* on the Eneabba sandplain also found a strong correlation between the number of inflorescences and rainfall from the previous winter and spring, with the number of flowers per year decreasing by approximately five for every 100mm decrease in rainfall (Lamont and Enright 2000, cited in Burns *et al*. 2014). This would suggest that rainfall from the previous year is one of several significant factors that determine annual flowering intensity.

However, a study in south eastern Australia found that the mean number of Banksia flowers varied markedly between years and flowering intensity was not influenced by rainfall, but did follow a crudely biennial cycle (Copland and Whelan 1989). Furthermore, rainfall at Cooljarloo between 2009 and 2013 has followed a biennial cycle (Tables 8 and 9), which makes it difficult to differentiate between the influence of 1) rainfall and 2) phenology of the two Banksia species on annual flowering intensity.

Table 8. Mean *Banksia attenuata* flower counts in summer at Falcon South, North Mine (South Transect) and Dump 1 from 2010 to 2014.

Area	Mean summer flower counts (*Banksia attenuata*)				
	2010/2011	**2011/2012**	**2012/2013**	**2013/2014**	**2014/2015**
	13 Aug 2011*	4 Dec 2011	27 Nov 2012	23 Nov 2013	17 Nov 2014
Falcon South	41.9	0.3	4.3	1.1	22.4
North Mine (South Transect)	12.9	0.6	2.7	3.3	10.6
Dump 1 Rehab	30.3	2.4	5.2	0	31.8
Mean flower counts of all sites	28.4	1.1	4.1	1.5	21.6
Previous years rainfall (mm)	538.2	400.6	588.4	475.8	534.6

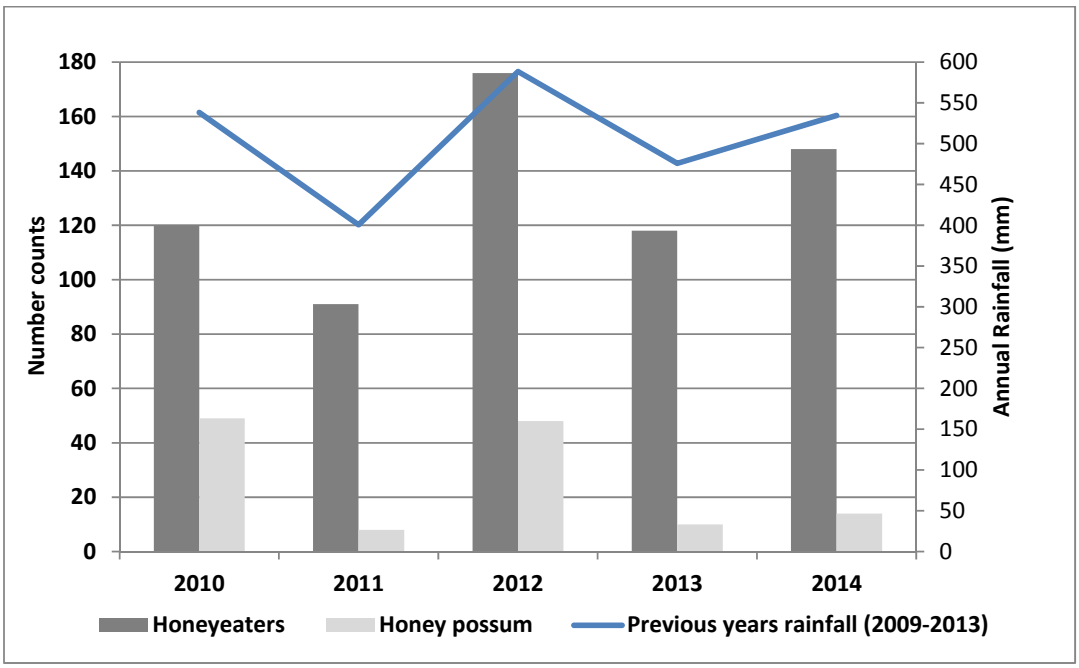
*Summer 2010 flowers derived from old flower cones in 2011. Previous years rainfall 2009-2013.

Table 9. Mean *Banksia menziesii* flower counts in winter at Falcon South, North Mine (South Transect) and Dump 1 from 2010 to 2014.

Area	Mean winter flower counts (*Banksia menziesii*)				
	2010	**2011**	**2012**	**2013**	**2014**
	13 Aug 2011*	13 Aug 2011	27 Nov 2012	23 Jul 2013	2 Aug 2014
Falcon South	9.5	0.1	1.3	0.1	6
North Mine (South Transect)	8.7	0	4	0	3.1
Dump 1 Rehab	16.3	0	11.9	0.5	9.8
Mean flower counts of all sites	11.5	0.04	5.7	0.2	6.3
Previous years rainfall (mm)	538.2	400.6	588.4	475.8	534.6

*Winter 2010 flowers derived from old flower cones in 2011. Previous years rainfall 2009-2013.

Although a rudimentary correlation, Honey Possum captures at North Mine (North and South transects and winter/spring results pooled) were higher in 2010, 2012 and 2014 and coincide with the increase in flowering intensity (Tables 8 and 9) and previous years rainfall (Figure 12). The same trend can be seen with several Honeyeater species (Brown, White-cheeked and Tawny-crowned Honeyeater results pooled).



Honeyeater species: Brown, White-cheeked and Tawny-crowned Honeyeater.

Figure 12. Honeyeater counts and Honey Possum captures at North and South transects (winter/spring results pooled) from 2010 to 2014 and previous year's rainfall (2009-2013).

3.4 Recommendations

Fauna investigations at Cooljarloo have been conducted and reported annually since 1989, and this has led to a good understanding of the short and long-term impacts on fauna from mining and mulching operations. Results from rehabilitation monitoring suggest that several species return to newly-created habitat relatively quickly, provided good environmental conditions are present. A small but diverse assemblage of pioneer species recolonise and/or forage in the rehabilitated area at different times, depending on several factors such as vegetation structure and food availability. Common early colonisers include: the Western Bearded Dragon, Western Heath Dragon, Honey Possum, House Mouse, White-winged Fairy-wren and Australasian Pipit.

Studies to date have identified a number of factors which encourage fauna recolonisation into rehabilitated areas and include:

- Reconstructing the landform topography and hydrology to its pre-disturbed state. Importantly, a soil profile of a sandy topsoil with organic matter to encourage burrowing species and soil flora and fauna;
- Creating various diverse habitat structures such as, dense vegetation, organic matter, rocks and logs as soon as practicable;
- Providing habitat diversity with numerous local plant species suited to frogs, reptiles and birds (including recalcitrant species). For example, Banksia species for conservation significant birds such as the Carnaby's Black-Cockatoo;
- Reducing disturbance and distance to surrounding native vegetation to allow greater rates of recolonisation; and
- Managing impacting processes such as:
    - Increased mortality from feral predators and road kill;
    - Introduced weed species;
    - Fire;
    - Dieback (*Phytophthora sp*); and
    - Erosion.

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5 Appendices

Appendix 1. Total pitfall captures (all surveys) of each species at the BACI monitoring sites (Falcon and North Mine).

Species		Falcon North	Falcon South	North Transect	South Transect
Frogs					
Western Spotted Frog	*Heleioporus albopunctatus*			1	8
Moaning Frog	*Heleioporus eyrei*	55	43	75	68
Sand Frog	*Heleioporus psammophilus*	32	11	1	2
Banjo Frog, Pobblebonk	*Limnodynastes dorsalis*			31	22
Humming Frog	*Neobatrachus pelobatoides*	1	6	46	66
Squelching Froglet	*Crinia insignifera*				2
Turtle Frog	*Myobatrachus gouldii*	1	7	66	60
Günther's Toadlet	*Pseudophryne guentheri*	23		12	14
Reptiles					
Western Heath Dragon	*Ctenophorus adelaidensis*	75	53	456	382
Western Bearded Dragon	*Pogona minor*	23	24	165	131
Spotted Stone Gecko	*Diplodactylus polyopthalmus*		1		
White-spotted Ground Gecko	*Lucasium alboguttatum*		17	24	44
Soft Spiny-tailed Gecko	*Strophurus spinigerus*	2	1	37	17
Marbled Gecko	*Christinus marmoratus*	2	3	11	5
Javelin Legless Lizard	*Delma concinna*			4	1
Fraser's Legless Lizard	*Delma fraseri*		1	2	
Gray's Legless Lizard	*Delma grayii*			1	1
Keeled Legless Lizard	*Pletholax gracilis*			1	4
Common Scaly-foot	*Pygopus lepidopodus*			1	1
Buchanan's Skink	*Cryptoblepharus buchananii*	4	1	17	14
Western Limestone Ctenotus	*Ctenotus australis*			6	3
West Coast Ctenotus	*Ctenotus fallens*	15	11	238	220
Jewelled Ctenotus	*Ctenotus gemmula*		1	26	10
South-western Odd-striped Ctenotus	*Ctenotus impar*			97	25
Leopard Ctenotus	*Ctenotus pantherinus*			6	
Bull Skink	*Egernia multiscutata*	2		1	
Salmon-bellied Skink	*Egernia napoleonis*		1	3	3
Bold-striped Four-toed Lerista	*Lerista christinae*	2	6		
West Coast Four-toed Lerista	*Lerista elegans*	31	3	6	7
Western Worm Lerista	*Lerista praepedita*	6	2	52	38
Common Dwarf Skink	*Menetia greyii*	9	5	3	12
Western Pale-flecked Morethia	*Morethia lineoocellata*	1	2	6	8
Dusky Morethia	*Morethia obscura*	10	38	131	103
Bobtail	*Tiliqua rugosa*		1	3	2
Sand Goanna	*Varanus gouldii*		1	1	1
Southern Blind Snake	*Ramphotyphlops australis*	1		5	2
Shovel-nosed Snake	*Brachyurophis fasciolata*				1
Bardick	*Echiopsis curta*			1	4

Species		Falcon North	Falcon South	North Transect	South Transect
Black-naped Snake	*Neelaps bimaculatus*	2	1	1	
Black-striped Snake	*Neelaps calonotos*	1		2	
Gould's Snake	*Parasuta gouldii*			1	
Mulga Snake	*Pseudechis australis*		1		
Gwardar	*Pseudonaja mengdeni*			1	
Mammals					
Echidna	*Tachyglossus aculeatus*		1	1	
Fat-tailed Dunnart	*Sminthopsis crassicaudata*	2	2	2	2
Little Long-tailed Dunnart	*Sminthopsis dolichura*			11	10
White-tailed Dunnart	*Sminthopsis granulipes*		1	129	17
Grey-bellied Dunnart	*Sminthopsis griseoventer*	1	1	24	5
Honey Possum	*Tarsipes rostratus*	57	85	608	502
House Mouse	*Mus musculus*	139	130	428	365
Ash-grey Mouse/Noodji	*Pseudomys albocinereus*	85	152	337	102
Western Bush Rat/Moodit	*Rattus fuscipes*			3	7
Total captures		**582**	**613**	**3084**	**2291**
Species richness		**26**	**32**	**47**	**41**
Trap-nights		**2500**	**2500**	**13495**	**11070**
Captures per 100 trap-nights		**23.4**	**24.5**	**22.8**	**20.7**
Transect data pooled					
Total captures		**1195**		**5375**	
Total species richness		**36**		**49**	
Trap-nights		**5000**		**24565**	
Captures per 100 trap-nights		**23.9**		**21.8**	

Appendix 2. Total count of each bird species (all surveys) at the BACI monitoring sites (Falcon and North Mine).

Species		Falcon North	Falcon South	North Transect	South Transect
Emu	*Dromaius novaehollandiae*				4
Stubble Quail	*Coturnix pectoralis*		1		
Pacific Black Duck	*Anas superciliosa*	1			
Common Bronzewing	*Phaps chalcoptera*	6	6	2	6
Crested Pigeon	*Ocyphaps lophotes*	17			7
Square-tailed Kite	*Lophoictinia isura*	1	4		
Wedge-tailed Eagle	*Aquila audax*	1			1
Nankeen Kestrel	*Falco cenchroides*	7		1	
Brown Falcon	*Falco berigora*	2	2	5	7
Red-capped Plover	*Charadrius ruficapillus*	2			
Banded Lapwing	*Vanellus tricolor*	7			
Painted Button-quail	*Turnix varius*	1		3	1
Carnaby's Black-Cockatoo	*Calyptorhynchus latirostris*	106		14	67
Galah	*Eolophus roseicapillus*	7	9	8	3
Regent Parrot	*Polytelis anthopeplus*		35	6	6
Australian Ringneck	*Barnardius zonarius*		2	2	
Elegant Parrot	*Neophema elegans*		10		5
Horsfield's Bronze-Cuckoo	*Chalcites basalis*	1	6	3	
Pallid Cuckoo	*Cacomantis pallidus*			2	1
Southern Boobook	*Ninox novaeseelandiae*		1		
Red-backed Kingfisher	*Todiramphus pyrrhopygius*			1	
Rainbow Bee-eater	*Merops ornatus*		2		2
Splendid Fairy-wren	*Malurus splendens*	2	12	4	
White-winged Fairy-wren	*Malurus leucopterus*	6	5	1	9
Variegated Fairy-wren	*Malurus lamberti*	9	32	38	10
Southern Emu-wren	*Stipiturus malachurus*	11		2	

Species		Falcon North	Falcon South	North Transect	South Transect
White-browed Scrubwren	*Sericornis frontalis*			1	
Rufous Fieldwren	*Calamanthus campestris*	5	3	7	1
Western Gerygone	*Gerygone fusca*	2			
Yellow-rumped Thornbill	*Acanthiza chrysorrhoa*	32	7	9	15
Western Thornbill	*Acanthiza inornata*	41	49	17	11
Inland Thornbill	*Acanthiza apicalis*	1	3	1	
Western Spinebill	*Acanthorhynchus superciliosus*	13	15	3	
Pied Honeyeater	*Certhionyx variegatus*	2			
Singing Honeyeater	*Lichenostomus virescens*		8	27	47
Yellow-throated Miner	*Manorina flavigula*	23			
Western Wattlebird	*Anthochaera lunulata*	8	20		6
Red Wattlebird	*Anthochaera carunculata*	5	4	2	2
White-fronted Chat	*Epthianura albifrons*	1			
Black Honeyeater	*Sugomel niger*	16	1		
Tawny-crowned Honeyeater	*Glyciphila melanops*	49	79	44	49
Brown Honeyeater	*Lichmera indistincta*	204	246	284	286
White-cheeked Honeyeater	*Phylidonyris niger*	48	126	166	144
Brown-headed Honeyeater	*Melithreptus brevirostris*			27	9
Varied Sittella	*Daphoenositta chrysoptera*		14	8	7
Black-faced Cuckoo-shrike	*Coracina novaehollandiae*	5	8	10	1
White-winged Triller	*Lalage sueurii*	13	16	37	9
Rufous Whistler	*Pachycephala rufiventris*	11	21	18	20
Grey Shrike-thrush	*Colluricincla harmonica*	1	8	5	8
Crested Bellbird	*Oreoica gutturalis*	3	14	11	7
Black-faced Woodswallow	*Artamus cinereus*	11	15	55	7
Dusky Woodswallow	*Artamus cyanopterus*		48	1	
Grey Butcherbird	*Cracticus torquatus*	4	2	1	1
Australian Magpie	*Cracticus tibicen*	2	1	1	9

Species		Falcon North	Falcon South	North Transect	South Transect
Grey Fantail	*Rhipidura albiscapa*	1	1		
Willie Wagtail	*Rhipidura leucophrys*	8	8	21	6
Australian Raven	*Corvus coronoides*	8	5	3	7
Magpie-lark	*Grallina cyanoleuca*	2	1		
Hooded Robin	*Melanodryas cucullata*	2	6	3	
Rufous Songlark	*Cincloramphus mathewsi*		7	9	
Brown Songlark	*Cincloramphus cruralis*	1	1		
Silvereye	*Zosterops lateralis*	22	23	13	11
White-backed Swallow	*Cheramoeca leucosterna*	1		2	14
Welcome Swallow	*Hirundo neoxena*	3		2	11
Tree Martin	*Petrochelidon nigricans*	1	2	8	1
Australasian Pipit	*Anthus novaeseelandiae*	17	7	8	12
Total number of observations		**753**	**896**	**897**	**830**
Species richness		**51**	**46**	**47**	**40**
Point-counts		**2500**	**2500**	**4110**	**2710**
Birds per 100 point-counts		**30.1**	**35.8**	**21.8**	**30.6**
Transect data pooled					
Total number of observations		**1649**		**1727**	
Total species richness		**61**		**50**	
Point-counts		**5000**		**6820**	
Birds per 100 point-counts		**32.9**		**25.3**	

Appendix 3. Numbers of captures of frogs, reptiles and small mammals on North Transect, spring 1990 to spring 2014.

Winter samples

Year:	91	92	93	95	96	99	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14
Sampling effort	**216**	**180**	**180**	**360**	**360**	**360**	**360**	**360**	**355**	**330**	**345**	**285**	**220**	**220**	**220**	**220**	**220**	**220**	**220**	**220**	**220**
FROGS																					
H. albopunctatus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
H. psammophilus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-
H. eyrei	3	2	2	-	3	-	2	8	1	2	4	1	1	-	-	-	1	1	-	-	-
L. dorsalis	-	2	-	-	4	-	1	3	2	-	-	2	1	-	-	-	-	-	-	1	-
M. gouldii	-	1	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	1	-
N. pelobatoides	2	2	-	-	9	1	-	4	1	2	1	1	-	-	-	-	-	-	-	-	-
P. guentheri	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
REPTILES																					
C. marmoratus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
D. concinna	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
D. fraseri	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P. gracilis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P. minor	1	2	-	1	3	2	4	-	-	1	1	1	3	-	1	3	2	3	-	2	-
C. adelaidensis	1	-	-	1	1	5	20	1	-	-	-	2	-	1	-	-	-	-	3	-	2
C. buchananii	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C. fallens	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-
C. gemmula	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
C. impar	2	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	2	-	-
C. australis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C. pantherinus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
E. napoleonis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. elegans	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. praepedita	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	1	-	-
M. lineoocellata	3	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
M. obscura	-	2	-	5	-	2	5	-	1	1	-	-	-	1	2	1	3	-	-	-	-
T. rugosa	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-

Grey shading: fire event (1994 and 2003). Beige shading: mining operations (2005-2010).

Winter samples, North Transect (cont.)

Year:	91	92	93	95	96	99	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14
Sampling effort	**216**	**180**	**180**	**360**	**360**	**360**	**360**	**360**	**355**	**330**	**345**	**285**	**220**	**220**	**220**	**220**	**220**	**220**	**220**	**220**	**220**
R. australis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P. gouldii	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
N. calonotus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
N. bimaculatus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P. nuchalis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MAMMALS																					
S. aff dolichura	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-
S. granulipes	-	-	-	-	1	5	1	9	3	-	-	-	-	-	-	1	-	1	-	3	8
S. griseoventer	-	-	-	-	-	-	-	-	-	3	1	-	-	-	-	-	-	1	-	-	-
T. rostratus	1	15	7	4	61	38	56	16	23	-	-										
M. musculus	6	9	7	3	12	22	6	3	15	2	2	5	1	-	12	6	8	4	14	11	2
P. albocinereus	9	-	-	5	10	8	4	25	12	-	4	-	4	1	25	9	11	9	2	1	1
R. fuscipes	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Frogs	5	8	2	-	16	1	3	15	4	4	5	5	2	-	-	-	1	1	1	2	-
Reptiles	7	4	-	7	4	11	31	1	1	2	2	3	4	2	3	4	5	3	7	1	3
Mammals	16	24	14	12	84	74	67	53	53	5	7	9	19	1	44	20	33	16	23	4	12
Total captures	28	36	16	19	104	86	101	69	58	11	14	17	25	3	47	24	39	20	31	20	15
N of species	9	9	3	6	9	11	11	8	8	6	7	8	7	3	5	6	6	7	8	7	6

Grey shading: fire event (1994 and 2003). Beige shading: mining operations (2005-2010).

Spring samples, North Transect

Year:	90	91	92	93	94	95	96	99	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14
Sampling effort	**216**	**216**	**180**	**180**	**180**	**360**	**360**	**360**	**360**	**360**	**355**	**330**	**345**	**220**	**220**	**220**	**220**	**220**	**220**	**220**	**220**	**220**	**220**
FROGS																							
H. albopunctatus	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
H. eyrei	5	3	3	-	-	4	3	3	5	-	2	2	1	-	-	-	1	-	-	-	-	-	-
H. eyrei/psam?	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-
L. dorsalis	-	1	2	1	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-
M. gouldii	-	4	-	10	-	-	1	6	-	1	3	-	-	-	-	3	-	2	11	-	4	1	-
N. pelobatoides	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P. guentheri	-	1	-	-	-	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
REPTILES																							
L. alboguttatum	1	-	-	-	-	-	-	1	-	-	-	1	-	-	1	1	3	7	2	2	1	2	3
S. spinigerus	2	-	1	2	1	1	4	4	-	9	-	-	1	-	2	1	-	1	1	-	2	1	6
C. marmoratus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	2	6	-	-	1
D. concinna	-	-	-	-	-	-	1	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-
D. fraseri	-	-	-	-	-	-	-	-	1	1	1	-	-	-	-	-	-	-	-	-	-	-	-
P. gracilis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-
P. lepidopodus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
P. minor	12	3	3	-	1	6	12	14	20	11	10	7	2	4	5	2	1	3	-	5	2	5	-
C. adelaidensis	20	12	17	1	8	34	38	44	37	38	16	7	12	27	30	13	3	23	1	10	2	13	2
C. buchananii	-	-	-	-	-	1	-	4	1	-	-	2	2	-	-	1	-	2	-	1	-	1	-
C. fallens	8	1	2	-	3	7	16	29	16	32	20	16	6	4	1	9	4	11	11	5	5	11	21
C. gemmula	1	1	3	-	-	1	-	3	1	-	-	1	-	-	-	3	-	1	2	3	-	2	1
C. impar	26	3	5	3	3	2	7	4	1	1	2	3	3	7	5	1	1	3	6	3	6	5	9
C. australis	-	-	-	-	-	-	-	4	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-
C. pantherinus	-	-	-	-	-	-	-	3	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-
E. napoleonis	1	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	3	-	-	-
L. elegans	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	3	-
L. praepedita	-	-	-	-	1	5	7	4	3	6	2	4	1	-	-	3	-	1	-	5	2	2	5
M. grayii	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	1
M. lineoocellata	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-

Grey shading: fire event (1994 and 2003). Beige shading: mining operations (2005-2010).

Spring samples, North Transect (cont.)

Year:	90	91	92	93	94	95	96	99	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14
Sampling effort	**216**	**216**	**180**	**180**	**180**	**360**	**360**	**360**	**360**	**360**	**355**	**330**	**345**	**220**	**220**	**220**	**220**	**220**	**220**	**220**	**220**	**220**	**220**
M. obscura	7	7	10	8	5	1	9	7	6	1	4	2	2	2	2	2	2	3	1	6	1	4	1
T. rugosa	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
V. gouldii	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-
R. australis	-	-	1	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
E. curta	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-
P. gouldii	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
N. calonotus	-	-	-	-	-	-	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
N. bimaculatus	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P. nuchalis	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MAMMALS																							
S. aff dolichura	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S. granulipes	-	-	-	-	-	1	1	8	2	5	7	-	-	-	-	1	1	3	2	5	9	14	19
S. griseoventer	-	-	-	2	-	-	3	10	4	4	2	-	-	-	-	-	-	-	-	-	-	-	-
T. rostratus	27	11	43	61	-	6	12	17	34	3	12	-	4	2	11	1	10	13	17	4	18	5	9
M. musculus	10	4	21	10	4	13	5	18	12	1	36	5	3	7	10	5	28	1	9	6	25	12	8
P. albocinereus	4	5	-	1	1	5	6	13	13	19	20	2	11	4	13	9	8	9	16	5	4	-	8
R. fuscipes	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Frogs	5	11	5	11	-	6	6	10	5	1	5	2	2	-	-	3	1	2	11	-	6	1	-
Reptiles	78	27	43	14	23	60	97	123	89	101	56	44	29	44	46	38	14	57	28	48	22	50	52
Mammals	41	21	64	74	5	25	27	66	65	32	77	7	18	13	34	15	47	26	44	20	56	31	44
Total captures	124	59	112	99	28	91	130	199	159	134	138	53	49	57	80	56	62	85	83	68	84	82	96
N of species	13	15	13	10	10	17	19	22	17	14	15	13	13	8	10	17	11	16	15	16	15	16	16

Grey shading: fire event (1994 and 2003). Beige shading: mining operations (2005-2010).

Numbers of captures of frogs, reptiles and small mammals on South Transect, spring 1990 to spring 2014.

Winter samples

Year:	91	92	93	95	96	99	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14
Sampling effort:	**186**	**155**	**155**	**310**	**310**	**310**	**310**	**310**	**270**	**265**	**285**	**160**	**150**	**150**	**150**	**200**	**200**	**200**	**200**	**200**	**200**
FROGS																					
C. insignifera	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	1	-
H. albopunctatus	-	-	-	-	-	-	2	1	-	-	2	-	-	-	-	-	-	-	-	-	-
H. eyrei	13	-	-	-	-	-	2	2	3	1	2	-	2	-	-	-	1	-	-	-	-
L. dorsalis	-	-	1	-	5	-	-	1	-	-	1	1	4	-	-	-	-	-	1	-	-
M. gouldii	-	-	1	-	1	-	-	-	2	-	3	-	-	-	-	-	-	-	-	-	-
N. pelobatoides	-	-	-	-	4	3	-	4	1	1	2	-	-	-	-	-	-	-	-	-	1
P. guentheri	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
REPTILES																					
L. alboguttatum	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-
S. spinigerus	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C. marmoratus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
D. concinna	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P. gracilis						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P. minor	1	3	1	1	5	2	5	-	-	4	1	-	4	-	1	-	-	-	-	1	-
C. adelaidensis	1	-	-	-	1	5	15	-	-	-	-	-	1	-	-	-	-	-	1	-	-
C. buchananii	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
C. fallens	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C. gemmula	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C. impar	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C. australis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
E. napoleonis	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-
L. elegans	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. praepedita	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
M. lineoocellata	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Grey shading: fire event (1994 and 2003). Beige shading: mining operations (2005-2009).

Winter samples, South Transect (cont.)

Year:	91	92	93	95	96	99	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14
Sampling effort:	**186**	**155**	**155**	**310**	**310**	**310**	**310**	**310**	**270**	**265**	**285**	**160**	**150**	**150**	**150**	**200**	**200**	**200**	**200**	**200**	**200**
M. obscura	1	-	-	-	2	2	1	-	-	-	-	-	1	-	-	1		-	3	-	5
M. greyii	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	1
R. australis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P. gouldii	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
N. calonotos	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
N. bimaculata	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
E. curtus	-	-	-	-	-	-	-	-	-	1	-	-	1	-	-	-	-	-	-	-	-
MAMMALS																					
S. aff dolichura	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6	-	-	-
S. granulipes	-	-	-	-	-	3	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-
S. griseoventer	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
T. rostratus	1	6	9	2	78	40	54	13	8	3	2	1	6	1	-	1	6	-	13	-	-
M. musculus	3	7	3	5	20	21	4	2	11	2	2	1	8	1	10	3	8	-	7	1	3
P. albocinereus	1	-	-	1	6	4	2	5	4	6	2	-	-	-	3	-	5	1	-	-	-
R. fuscipes	-	-	-	-	1	3	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Frogs	14	1	2	-	10	3	4	8	6	2	10	2	6	-	-	-	1	-	1	1	1
Reptiles	3	3	1	4	8	9	21	-	-	5	2	-	8	-	2	1	-	-	4	1	7
Mammals	5	13	12	6	105	71	59	20	24	11	6	2	14	2	13	4	19	7	20	1	3
Total captures	22	17	15	10	123	83	84	28	30	18	18	4	28	2	15	5	20	7	25	3	11
N of species	8	4	5	6	10	9	9	7	7	7	10	4	9	2	4	3	4	2	5	3	5

Grey shading: fire event (1994 and 2003). Beige shading: mining operations (2005-2009).

Spring samples, South Transect

Year:	90	91	92	93	94	95	96	99	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14
Sampling effort:	**186**	**186**	**155**	**155**	**155**	**310**	**310**	**310**	**310**	**310**	**270**	**265**	**190**	**155**	**150**	**150**	**150**	**200**	**200**	**200**	**200**	**200**	**200**
FROGS																							
H. albopunctatus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-
H. eyrei	4	3	1	-	-	3	1	-	2	-	1	2	1	-	-	-	3	-	1	1	1	2	1
H. psammophilus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-
L. dorsalis	-	-	-	1	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
M. gouldii	-	10	-	5	-	-	-	3	1	-	2	-	-	-	-	2	-	-	1	-	-	-	-
N. pelobatoides	-	1	-	-	1	-	1	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-
P. guentheri	-	-	-	-	-	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-
REPTILES																							
L. alboguttatum	-	-	-	-	-	-	-	2	-	1	-	-	-	1	2	9	3	3	1	1	1	5	8
S. spinigerus	4	-	-	-	1	2	2	1	1	1	1	1	-	-	-	-	-	-	-	2	1	1	1
C. marmoratus	1	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	1	-	-	2	-	-	-
D. concinna	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P. gracilis								2	1	-	-	-	-	-	-	-	-	-	-	-	-	1	-
P. lepidopodus																					1		-
P. minor	5	4	2	2	-	6	14	11	14	14	13	6	3	1	-	2	-	1	1	1	2	2	-
C. adelaidensis	20	18	14	2	6	31	50	41	41	22	24	15	7	5	8	6	2	15	8	7	2	7	5
C. buchananii	-	-	-	-	1	3	-	-	1	-	-	-	-	-	1	-	1	-	3	1	1	-	1
C. fallens	21	4	3	1	7	13	13	36	15	38	17	23	4	3	3	3	3	1	1	1	4	6	4
C. gemmula	1	-	1	-	-	1	1	1	-	1	2	-	-	-	-	-	-	-	-	1	1	-	-
C. impar	9	1	2	-	4	3	4	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C. australis	1	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
E. napoleonis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-
L. elegans	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	6	-	-	-
L. praepedita	1	-	-	-	-	2	-	1	1	3	1	1	-	-	-	3	2	2	4	7	1	6	2
M. greyii	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	-	3	2	-	2

Grey shading: fire event (1994 and 2003). Beige shading: mining operations (2005-2009).

Spring samples, South Transect (cont.)

Year:	90	91	92	93	94	95	96	99	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14
Sampling effort:	**186**	**186**	**155**	**155**	**155**	**310**	**310**	**310**	**310**	**310**	**270**	**265**	**190**	**155**	**150**	**150**	**150**	**200**	**200**	**200**	**200**	**200**	**200**
M. lineoocellata	-	-	1	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	2
M. obscura	3	9	-	8	6	2	4	4	3	6	3	7	2	1	1	2	2	2	9	2	3	3	4
T. rugosa	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-
V. gouldii	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R. australis	-	-	-	2	1	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. fasciolata	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-
P. gouldii	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
N. calonotos	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
N. bimaculata	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
E. curtus	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-
MAMMALS								o															
S. crassicaudata	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	1	-	-	-	-
S. aff. dolichura	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-
S. granulipes	1	-	-	1	-	-	-	1	-	5	1	-	-	-	-	-	-	1	-	-	1	1	1
S. griseoventer	-	1	-	-	-	1	-	-	1	1	-	-	-	-	-	-	1	-	1	-	-	-	-
T. rostratus	7	8	24	36	3	7	12	24	30	5	11	-	1	-	14	1	1	4	12	4	10	4	4
M. musculus	17	4	11	11	1	6	11	17	13	2	24	7	15	5	9	1	15	3	21	6	26	6	7
P. albocinereus	-	-	-	-	1	4	7	5	4	2	13	1	-	-	-	-	4	3	1	2	-	-	1
R. fuscipes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Frogs	4	14	1	6	1	8	4	3	3	1	3	2	1	-	-	2	3	-	3	1	2	2	1
Reptiles	66	36	23	15	26	64	91	100	79	88	62	54	16	11	16	23	15	29	27	39	19	31	29
Mammals	25	13	35	48	5	18	30	47	48	15	49	8	17	5	23	2	21	11	36	12	38	11	13
Total captures	95	63	59	69	32	90	125	150	130	104	114	64	34	16	39	27	39	40	66	52	59	44	43
N of species	14	11	9	10	11	16	15	15	15	15	14	10	8	6	8	10	13	13	15	17	17	12	14

Grey shading: fire event (1994 and 2003). Beige shading: mining operations (2005-2009).

Appendix 4. Bird observations at North Transect, spring 2007 - 2014.

Winter samples

Species	2008	2009	2010	2011	2012	2013	2014
Emu							
Pacific Black Duck							
Wedge-tailed Eagle							
Little Eagle							
Brown Falcon	3						
Nankeen Kestrel							
Painted Button-quail							
Common Bronzewing						1	
Crested Pigeon							
Carnaby's Black-Cockatoo					14		
Galah	1			5			
Regent Parrot							
Elegant Parrot							
Australian Ringneck							
Pallid Cuckoo				2			
Horsfield's Bronze-Cuckoo		1		1			
Southern Boobook							
Red-backed Kingfisher							
Splendid Fairy-wren				1			
Variegated Fairy-wren		6			12		4
White-winged Fairy-wren						1	
White-browed Scrubwren							
Southern Emu-wren		2					
Rufous Fieldwren						2	
Western Thornbill			4			4	
Yellow-rumped Thornbill						2	
Inland Thornbill							
Red Wattlebird							

Spring samples

Species	2007	2008	2009	2010	2011	2012	2013	2014
Emu								
Pacific Black Duck								
Wedge-tailed Eagle								
Little Eagle								
Brown Falcon	3	2						
Nankeen Kestrel			1					
Painted Button-quail								
Common Bronzewing		1						
Crested Pigeon								
Carnaby's Black-Cockatoo								
Galah						2		
Regent Parrot	6							
Elegant Parrot								
Australian Ringneck		2						
Pallid Cuckoo								
Horsfield's Bronze-Cuckoo		1						
Southern Boobook								
Red-backed Kingfisher	1							
Splendid Fairy-wren								3
Variegated Fairy-wren	7	3			3		3	
White-winged Fairy-wren								
White-browed Scrubwren							1	
Southern Emu-wren								
Rufous Fieldwren		2		1	1			1
Western Thornbill	2	3			2		2	
Yellow-rumped Thornbill						5	2	
Inland Thornbill							1	
Red Wattlebird	1	1						

Winter samples, North Transect (cont.)

Species	2008	2009	2010	2011	2012	2013	2014
Singing Honeyeater			3	4	1	2	1
Brown-headed Honeyeater		7		6		2	
Brown Honeyeater	18	8	29	12	28	10	24
White-cheeked Honeyeater	9	15	11	16	23	19	8
Tawny-crowned Honeyeater	2	1	2	1	1	8	7
Western Spinebill				1			
Hooded Robin	2						
Varied Sittella	3			3			
Crested Bellbird		2		2		2	1
Rufous Whistler			7	2	3	1	
Grey Shrike-thrush					3	1	
Grey Fantail							
Willie Wagtail	1		2	3		1	
Black-faced Cuckoo-shrike		2		4			2
White-winged Triller			2	1	15		4
Black-faced Woodswallow	2	4	7	1	2	1	3
Dusky Woodswallow						1	
Grey Butcherbird							
Australian Magpie							
Australian Raven			1	1		1	
Australasian Pipit				4	2		2
White-backed Swallow	1						
Welcome Swallow							
Rufous Songlark					4		
Tree Martin							
Silvereye						5	
Mistletoebird							
Number of species	**10**	**10**	**10**	**19**	**12**	**18**	**10**
Total number of observations	**42**	**48**	**68**	**70**	**108**	**64**	**56**

Spring samples, North Transect (cont.)

Species	2007	2008	2009	2010	2011	2012	2013	2014
Singing Honeyeater	6		1	2	2	1	1	3
Brown-headed Honeyeater	6						2	4
Brown Honeyeater	28	8	7	8	15	24	34	31
White-cheeked Honeyeater	14	11				7	11	22
Tawny-crowned Honeyeater	8		3		1	2	5	3
Western Spinebill						2		
Hooded Robin	1							
Varied Sittella		2						
Crested Bellbird	1	1						2
Rufous Whistler	2	1			1		1	
Grey Shrike-thrush							1	
Grey Fantail								
Willie Wagtail	2	1			1	1		9
Black-faced Cuckoo-shrike					1	1		
White-winged Triller	5	1			1	2	5	1
Black-faced Woodswallow	16	2	7					10
Dusky Woodswallow								
Grey Butcherbird	1							
Australian Magpie								1
Australian Raven								
Australasian Pipit								
White-backed Swallow	1							
Welcome Swallow					2			
Rufous Songlark						4	1	
Tree Martin	5						3	
Silvereye	1				1		6	
Mistletoebird							1	
Number of species	**11**	**16**	**5**	**3**	**12**	**11**	**17**	**12**
Total number of observations	**117**	**42**	**19**	**11**	**31**	**51**	**80**	**90**

Bird observations at South Transect, spring 2007 - 2014.

Winter samples

Species	2008	2009	2010	2011	2012	2013	2014
Emu							
Pacific Black Duck							
Brown Goshawk							
Wedge-tailed Eagle							
Little Eagle							
Brown Falcon	2		1				
Painted Button-quail							
Common Bronzewing		2					
Crested Pigeon							
Carnaby's Black-Cockatoo			3		64		
Galah							
Regent Parrot							
Elegant Parrot			1		4		
Horsfield's Bronze-Cuckoo							
Pallid Cuckoo						1	
Southern Boobook							
Rainbow Bee-eater							
Splendid Fairy-wren							
Variegated Fairy-wren					2		
White-winged Fairy-wren					3		
Southern Emu-wren							
Rufous Fieldwren							
Western Thornbill		5			2	4	
Yellow-rumped Thornbill	1		2	4			
Red Wattlebird		1					

Spring samples

Species	2007	2008	2009	2010	2011	2012	2013	2014
Emu	2		1				1	
Pacific Black Duck								
Brown Goshawk								
Wedge-tailed Eagle	1							
Little Eagle								
Brown Falcon		4						
Painted Button-quail			1					
Common Bronzewing	2			1			1	
Crested Pigeon			3					
Carnaby's Black-Cockatoo								
Galah	3							
Regent Parrot		6						
Elegant Parrot								
Horsfield's Bronze-Cuckoo								
Pallid Cuckoo								
Southern Boobook								
Rainbow Bee-eater								2
Splendid Fairy-wren								
Variegated Fairy-wren			5				3	
White-winged Fairy-wren							6	
Southern Emu-wren								
Rufous Fieldwren							1	
Western Thornbill								
Yellow-rumped Thornbill		2	3		3			
Red Wattlebird	1							

Winter samples, South Transect (cont.)

Species	2008	2009	2010	2011	2012	2013	2014
Western Wattlebird			3				
Singing Honeyeater	6	2	7		3	6	
Brown-headed Honeyeater			5	2		2	
Brown Honeyeater	19	6	30	11	26	16	9
White-cheeked Honeyeater	22	12	23	11	8	2	6
Tawny-crowned Honeyeater	7	2	8		9	1	17
Black Honeyeater							
Western Spinebill							
Varied Sittella	7						
Crested Bellbird			2	1	1		
Rufous Whistler				5	1		
Black-faced Cuckoo-shrike							
Grey Shrike-thrush	1	1		1		2	
Grey Fantail							
Willie Wagtail							
White-winged Triller			5		3		
Black-faced Woodswallow				2			2
Grey Butcherbird							
Australian Magpie							
Australasian Pipit			4	5			
Australian Raven	2				1		
White-backed Swallow			1	12			
Welcome Swallow		1	4				
Tree Martin	1						
Silvereye		3					
Number of species	**10**	**10**	**15**	**10**	**13**	**8**	**4**
Total number of observations	**68**	**35**	**99**	**54**	**127**	**34**	**34**

Spring samples, South Transect (cont.)

Species	2007	2008	2009	2010	2011	2012	2013	2014
Western Wattlebird					3			
Singing Honeyeater	11	1	5	3	2	1		
Brown-headed Honeyeater								
Brown Honeyeater	57	17	12	7	20	27	12	17
White-cheeked Honeyeater	8	12	10	2	4	21		3
Tawny-crowned Honeyeater	1	2	1					1
Black Honeyeater								
Western Spinebill								
Varied Sittella								
Crested Bellbird	1		1				1	
Rufous Whistler	3	1			3	7		
Black-faced Cuckoo-shrike							1	
Grey Shrike-thrush		1	1				1	
Grey Fantail								
Willie Wagtail	2	2	2					
White-winged Triller			1					
Black-faced Woodswallow	2			1				
Grey Butcherbird	1							
Australian Magpie	5							4
Australasian Pipit					1	1	1	
Australian Raven	2				2			
White-backed Swallow							1	
Welcome Swallow	6							
Tree Martin								
Silvereye	1				5		2	
Number of species	**18**	**10**	**13**	**5**	**10**	**5**	**12**	**5**
Total number of observations	**109**	**48**	**46**	**14**	**47**	**57**	**31**	**27**

Appendix 5. Total pitfall captures (all surveys) of each species at the post-mining CI monitoring sites (Dump One).

Species		Dump One Control	Dump One Mulched	Dump One Rehabilitation	Dump One Soil Stockpile
Western Spotted Frog	*Heleioporus albopunctatus*	1	1	9	
Moaning Frog	*Heleioporus eyrei*	39	34	81	3
Sand Frog	*Heleioporus psammophilus*	25	26	69	2
Banjo Frog, Pobblebonk	*Limnodynastes dorsalis*	24	17	28	1
Humming Frog	*Neobatrachus pelobatoides*	1	13	64	2
Squelching Froglet	*Crinia insignifera*	1	4	10	
Turtle Frog	*Myobatrachus gouldii*	19	10		
Günther's Toadlet	*Pseudophryne guentheri*	8	11	96	9
Western Heath Dragon	*Ctenophorus adelaidensis*	140	165	185	16
Western Bearded Dragon	*Pogona minor*	104	54	72	1
Soft Spiny-tailed Gecko	*Strophurus spinigerus*	27	10	18	
Marbled Gecko	*Christinus marmoratus*	8	1		
Sand-plain Worm-lizard	*Aprasia repens*	1	3		
Javelin Legless Lizard	*Delma concinna*		4	5	3
Fraser's Legless Lizard	*Delma fraseri*	1	1	1	
Gray's Legless Lizard	*Delma grayii*			2	
Burton's Legless Lizard	*Lialis burtonis*	1			
Keeled Legless Lizard	*Pletholax gracilis*		1		
Common Scaly-foot	*Pygopus lepidopodus*		1	1	
Buchanan's Snake-eyed Skink	*Cryptoblepharus buchananii*	6	10		
Western Limestone Ctenotus	*Ctenotus australis*	1		1	
West Coast Ctenotus	*Ctenotus fallens*	34	52	10	10
South-west Odd-striped Ctenotus	*Ctenotus impar*	2			
Salmon-bellied Skink	*Egernia napoleonis*		1		
West Coast Four-toed Lerista	*Lerista elegans*	13	9		
Western Worm Lerista	*Lerista praepedita*	27	3		
Common Dwarf Skink	*Menetia greyii*	16	12	7	2

Species		Dump One Control	Dump One Mulched	Dump One Rehabilitation	Dump One Soil Stockpile
Dusky Morethia	*Morethia obscura*	6	3	1	
Western Blue-tongue	*Tiliqua occipitalis*		1	1	
Bobtail	*Tiliqua rugosa*		3		
Southern Blind Snake	*Ramphotyphlops australis*	4	3	1	
Southern Shovel-nosed Snake	*Brachyurophis semifasciata*		3		
Yellow-faced Whipsnake	*Demansia psammophis*		1		
Bardick	*Echiopsis curta*			1	
Black-naped Snake	*Neelaps bimaculatus*	3	1		
Gwardar	*Pseudonaja mengdeni*		1		
Little Long-tailed Dunnart	*Sminthopsis aff dolichura*	8	1		
White-tailed Dunnart	*Sminthopsis granulipes*	2	18	6	
Grey-bellied Dunnart	*Sminthopsis griseoventer*	25	18	2	
Honey Possum	*Tarsipes rostratus*	199	123	108	7
House Mouse	*Mus musculus*	106	98	256	27
Ash-grey Mouse	*Pseudomys albocinereus*	97	42	19	2
Western Bush Rat	*Rattus fuscipes*		1		
Total captures		**949**	**760**	**1054**	**85**
Species richness		**31**	**38**	**26**	**13**
Trap-nights		**4395**	**3900**	**6000**	**520**
Captures per 100 trap-nights		**21.5**	**19.5**	**17.6**	**16.3**

Appendix 6. Total count of each bird species (all surveys) at the post-mining CI monitoring sites (Dump One).

Species		Dump One Control	Dump One Mulched	Dump One Rehabilitation	Dump One Soil Stockpile
Emu	*Dromaius novaehollandiae*		6	2	1
Pacific Black Duck	*Anas superciliosa*	1			
Common Bronzewing	*Phaps chalcoptera*	1		22	
Brush Bronzewing	*Phaps elegans*				1
Crested Pigeon	*Ocyphaps lophotes*	1	11	5	1
White-faced Heron	*Egretta novaehollandiae*			2	
Square-tailed Kite	*Lophoictinia isura*			3	
Brown Goshawk	*Accipiter fasciatus*	1	1	1	
Wedge-tailed Eagle	*Aquila audax*			1	
Little Eagle	*Hieraaetus morphnoides*		1	1	
Brown Falcon	*Falco berigora*		2		
Painted Button-quail	*Turnix varius*	1	5	2	
Button-quail sp.	*Turnix sp.*			1	
Carnaby's Black-Cockatoo	*Calyptorhynchus latirostris*	7	12	5	
Galah	*Eolophus roseicapillus*	2	4	4	
Regent Parrot	*Polytelis anthopeplus*			1	
Australian Ringneck	*Barnardius zonarius*		2	2	2
Elegant Parrot	*Neophema elegans*			18	
Horsfield's Bronze-Cuckoo	*Chalcites basalis*	1	7	5	
Shining Bronze-Cuckoo	*Chalcites lucidus*			1	
Pallid Cuckoo	*Cacomantis pallidus*				
Rainbow Bee-eater	*Merops ornatus*			1	
Splendid Fairy-wren	*Malurus splendens*	3		15	
White-winged Fairy-wren	*Malurus leucopterus*			166	4
Variegated Fairy-wren	*Malurus lamberti*	62	11	29	6

Species		Dump One Control	Dump One Mulched	Dump One Rehabilitation	Dump One Soil Stockpile
Southern Emu-wren	*Stipiturus malachurus*			7	
Fairy-wren sp.	*Malurus sp.*		1	11	
White-browed Scrubwren	*Sericornis frontalis*			2	1
Rufous Fieldwren	*Calamanthus campestris*			17	2
Yellow-rumped Thornbill	*Acanthiza chrysorrhoa*	6	4	2	2
Western Thornbill	*Acanthiza inornata*	91	10	3	2
Inland Thornbill	*Acanthiza apicalis*			6	
Western Spinebill	*Acanthorhynchus superciliosus*	32	6		
Singing Honeyeater	*Lichenostomus virescens*	5	45	4	
White-fronted Honeyeater	*Purnella albifrons*			7	
Western Wattlebird	*Anthochaera lunulata*	4	2	1	
Red Wattlebird	*Anthochaera carunculata*	2		1	
White-fronted Chat	*Epthianura albifrons*			3	1
Black Honeyeater	*Sugomel niger*		4	38	
Tawny-crowned Honeyeater	*Glyciphila melanops*	6	57	89	5
Brown Honeyeater	*Lichmera indistincta*	761	261	182	24
White-cheeked Honeyeater	*Phylidonyris niger*	48	66	166	23
Brown-headed Honeyeater	*Melithreptus brevirostris*	1	33	7	1
Varied Sittella	*Daphoenositta chrysoptera*	18	16	7	
Black-faced Cuckoo-shrike	*Coracina novaehollandiae*	1		1	
White-winged Triller	*Lalage sueurii*		7	13	
Rufous Whistler	*Pachycephala rufiventris*	27	12	4	
Grey Shrike-thrush	*Colluricincla harmonica*		3		
Crested Bellbird	*Oreoica gutturalis*		3		
Black-faced Woodswallow	*Artamus cinereus*		9	1	
Grey Butcherbird	*Cracticus torquatus*	2			
Australian Magpie	*Cracticus tibicen*		2	3	

Species		Dump One Control	Dump One Mulched	Dump One Rehabilitation	Dump One Soil Stockpile
Grey Fantail	*Rhipidura albiscapa*	1			
Willie Wagtail	*Rhipidura leucophrys*		14	4	2
Australian Raven	*Corvus coronoides*	8		4	
Red-capped Robin	*Petroica goodenovii*	4	1		
Hooded Robin	*Melanodryas cucullata*		1		
Rufous Songlark	*Cincloramphus mathewsi*		17		2
Silvereye	*Zosterops lateralis*	7	12	67	9
White-backed Swallow	*Cheramoeca leucosterna*			12	
Welcome Swallow	*Hirundo neoxena*	2	2	5	
Tree Martin	*Petrochelidon nigricans*			13	
Mistletoebird	*Dicaeum hirundinaceum*	1		3	
Zebra Finch	*Taeniopygia guttata*			1	
Australasian Pipit	*Anthus novaeseelandiae*			1	3
Total number of observations		**1109**	**650**	**973**	**92**
Species richness		**31**	**35**	**54**	**19**
Point-counts		**3395**	**2400**	**4000**	**320**
Birds per 100 point counts		**32.6**	**27.1**	**24.3**	**28.8**

Appendix 7. Banksia flower counts at Falcon South, North Mine (South Transect) and Dump One Rehabilitation site in 2011 (August, December), 2012 (November), 2013 (July, November) and 2014 (August, November).

Note*:* While *B. menziesii* flowers in winter and *B. attenuata* in summer, flowers on both species were counted in most surveys as it is possible to recognise flowers from the previous season. This is important for detecting late flowers, especially on *B. attenuata* which can flower in late summer and therefore many flowers could be missed in November, but will be apparent in August.

NA – Not Applicable; NV – Not Visited

***Banksia attenuata* – summer flower counts**

Area	Tree code	2010/2011	2011/2012	2012/2013	2013/2014	2014/2015
		13 Aug 2011*	4 Dec 2011	27 Nov 2012	23 Nov 2013	17 Nov 2014
Falcon South	BA1	31	0	2	1	27
	BA2	8	0	0	0	0
	BA3	37	0	8	0	18
	BA4	18	0	5	0	12
	BA5	32	0	3	0	43
	BA6	79	0	0	0	43
	BA7	61	0	9	0	33
	BA8	69	2	3	7	16
	BA9	30	1	0	1	19
	BA10	54	0	13	2	13
North Mine (South Transect)	BA11	22	3	3	6	7
	BA12	11	0	7	0	5
	BA13	16	0	4	0	18
	BA14	2	0	0	0	28
	BA15	18	0	10	0	40
	BA16	11	NV	0	0	0
	BA17	9	NV	0	1	2
	BA18	18	NV	2	3	5
	BA19	9	NV	0	0	0
	BA20	13	NV	1	0	1
Dump One	BA21	56	NV	11	0	46
	BA22	4	NV	0	0	6
	BA23	17	NV	4	0	47
	BA24	25	NV	0	0	9
	BA25	54	NV	1	0	20
	BA26	22	2	12	0	46
	BA27	61	10	12	0	74
	BA28	18	0	6	0	13
	BA29	7	0	0	0	12
	BA30	39	0	6	0	45
Total *B. att*		851	18	122	21	648

Note: In August 2011, it was possible to backdate some older flowers from the previous year, thus giving counts for both 2010 and 2011.

***Banksia menziesii* – winter flower counts**

Area	Tree code	2010	2011	2012	2013	2014
		13 Aug 2011*	13 Aug 2011	27 Nov 2012	23 Jul 2013	2 Aug 2014
Falcon South	BM1	8	0	0	0	4
	BM2	2	0	0	0	0
	BM3	25	0	1	dead	
	BM3 (2)				0	10
	BM4	9	0	0	0	18
	BM5	0	0	dead		
	BM5 (2)			0	0	0
	BM6	6	0	0	0	1
	BM7	16	0	0	0	dead
	BM7 (2)					7
	BM8	4	0	6	0	1
	BM9	11	1	2	1	8
	BM10	14	0	4	0	11
North Mine (South Transect)	BM11	16	0	12	0	0
	BM12	11	0	6	0	5
	BM13	8	0	3	0	2
	BM14	4	0	1	0	6
	BM15	9	0	3	0	2
	BM16	13	0	6	0	4
	BM17	5	0	4	0	1
	BM18	10	0	2	0	0
	BM19	6	0	2	0	9
	BM20	5	0	1	0	2
Dump One	BM21	2	0	10	0	8
	BM22	18	0	15	0	7
	BM23	26	0	13	0	6
	BM24	11	0	6	4	11
	BM25	16	0	14	0	14
	BM26	7	0	5	0	1
	BM27	15	0	5	0	3
	BM28	17	0	13	0	31
	BM29	13	0	1	1	3
	BM30	38	0	37	0	14
Total *B. men*		345	1	172	6	189

Note: In August 2011, it was possible to backdate some older flowers from the previous year, thus giving counts for both 2010 and 2011

Appendix 8. Conservation significant fauna species expected to occur and recorded at Falcon, North Mine and Dump 1, based on desktop review (Bamford *et al*. 2013) and field investigations.

Common Name	Species Name	Conservation Status			Recorded at Cooljarloo	Recorded at Falcon, North Mine or Dump1	Expected status
		CS1	CS2	CS3			
FROGS							
Squelching Froglet	*Crinia insignifera*			CS3	X	NM, D1	Resident
REPTILES							
Jewelled Ctenotus	*Ctenotus gemmula*		P3		X	Fal, NM	Resident
Woma, Ramsay`s Python	*Aspidites ramsayi*	S1, S4	P1				Probably locally extinct
Black-striped Snake	*Neelaps calonotos*		P3		X	Fal, NM	Resident
Carpet Python	*Morelia spilota*	S4	P4		X		Resident
Speckled Stone Gecko	*Diplodactylus polyophthalmus*			CS3	X	Fal	Resident
Bold-striped Lerista	*Lerista christinae*			CS3	X	Fal	Resident
BIRDS							
Carnaby's Black-Cockatoo	*Calyptorhynchus latirostris*	En, S1			X	Fal, NM, D1	Regular visitor
Peregrine Falcon	*Falco peregrinus*	S4					Irregular visitor
Fork-tailed Swift	*Apus pacificus*	Mig, S3					Irregular visitor
Rainbow Bee-eater	*Merops ornatus*	Mig, S3			X	Fal, NM, D1	Regular visitor
Migratory Waterbirds		Mig, S3			X		Irregular visitors
Western Ground Parrot	*Pezoporus flaviventris*	Cr, Mig					Possible resident but may be locally extinct
Australian Bustard	*Ardeotis australis*		P4		X		Irregular visitor
Rufous Fieldwren	*Calamanthus campestris*		P4		X	Fal, NM, D1	Resident
Crested Bellbird	*Oreoica gutturalis*		P4		X	Fal, NM, D1	Irregular visitor
Square-tailed Kite	*Lophoictinia isura*			CS3	X	Fal, NM, D1	Regular visitor
Southern Emu-wren	*Stipiturus malachurus*			CS3	X	Fal, NM, D1	Resident
Scarlet Robin	*Petroica multicolor*			CS3	X		Resident
White-breasted Robin	*Eopsaltria georgiana*			CS3	X		Resident
Mammals							
Chuditch	*Dasyurus geoffroii*	Vul,					Locally extinct

Common Name	Species Name	Conservation Status			Recorded at Cooljarloo	Recorded at Falcon, North Mine or Dump1	Expected status
		CS1	CS2	CS3			
		S1					
Tammar Wallaby	*Macropus eugenii*		P5		X		Probably locally extinct*
Brush Wallaby	*Macropus irma*		P4		X		Resident
Quenda	*Isoodon obesulus*		P5				Locally extinct
Brushtail Possum	*Trichosurus vulpecula*			CS3	X		Irregular visitor
Western Freetail-Bat	*Mormopterus sp 4.*			CS3	X		Irregular visitor

*Single specimen observed in 2006 was probably an animal released in Nambung National Park as part of a trial relocation project and no further sightings have been made.

See Appendix 9 for descriptions of conservation significance levels.

EPBC Act listed species: V = Vulnerable, En = Endangered, Cr = Critically Endangered, Mig = Migratory.

WC Act listed species: S1 = Schedule 1, S3 = Schedule3, S4 = Schedule 4, DPaW Priority Species: P1 = Priority 1, P3 = Priority 3, P4 = Priority 4, P5 = Priority 5.

Appendix 9.Categories used in the assessment of conservation status.

IUCN categories (based on review by Mace and Stuart 1994) as used for the *Environment Protection and Biodiversity Conservation Act 1999* and the Western Australian *Wildlife Conservation Act 1950*.

Extinct	Taxa not definitely located in the wild during the past 50 years.
Extinct in the Wild	Taxa known to survive only in captivity.
Critically Endangered	Taxa facing an extremely high risk of extinction in the wild in the immediate future.
Endangered	Taxa facing a very high risk of extinction in the wild in the near future.
Vulnerable	Taxa facing a high risk of extinction in the wild in the medium-term future.
Near Threatened	Taxa that risk becoming Vulnerable in the wild.
Conservation Dependent	Taxa whose survival depends upon ongoing conservation measures. Without these measures, a conservation dependent taxon would be classed as Vulnerable or more severely threatened.
Data Deficient (Insufficiently Known)	Taxa suspected of being Rare, Vulnerable or Endangered, but whose true status cannot be determined without more information.
Least Concern.	Taxa that are not Threatened.

Schedules used in the WA *Wildlife Conservation Act 1950*

Schedule 1	Rare and Likely to become Extinct.
Schedule 2	Extinct.
Schedule 3	Migratory species listed under international treaties.
Schedule 4	Other Specially Protected Fauna

WA Department of Parks and Wildlife Priority species (species not listed under the *Wildlife Conservation Act 1950*, but for which there is some concern).

Priority 1	Taxa with few, poorly known populations on threatened lands.
Priority 2	Taxa with few, poorly known populations on conservation lands; or taxa with several, poorly known populations not on conservation lands.
Priority 3	Taxa with several, poorly known populations, some on conservation lands.
Priority 4.	Taxa in need of monitoring. Taxa which are considered to have been adequately surveyed, or for which sufficient knowledge is available, and which are considered not currently threatened or in need of special protection, but could be if present circumstances change.
Priority 5	Taxa in need of monitoring. Taxa which are not considered threatened but are subject to a specific conservation program, the cessation of which would result in the species becoming threatened within five years (IUCN Conservation Dependent).