

Eco health report

2022



Buckaringa
Wildlife Sanctuary

Summary

Australian Wildlife Conservancy (AWC) has implemented its Ecological Health Monitoring Program (Ecohealth) on Buckaringa Wildlife Sanctuary (Buckaringa), to measure and evaluate the changes in the status and trend of conservation assets, and threats to those assets. Metrics from the program and the results of evaluation are reported in annual Ecohealth Reports and Scorecards. This is the Ecohealth Report for Buckaringa for 2022. Values of metrics derived in this report were based on data collected during surveys carried out between 2008 and 2022. The complete set of metrics, their most recent values and evaluations against relevant performance criteria are summarised in the accompanying Ecohealth Scorecard.

In implementing the Ecohealth program on Buckaringa in 2022, AWC conducted a survey for the Yellow-footed Rock-wallaby (*Petrogale xanthopus*) and a Standard Bird Survey, both of which have been undertaken most years for more than a decade. A Large Herbivore Survey and a Feral Predator Survey were also conducted. These surveys detected one threatened mammal (the rock-wallaby), one threatened bird (Southern Whiteface, *Aphelocephala leucopsis*), another 27 bird species, three native herbivore species and three introduced species.

Interpretation of survey results on Buckaringa is facilitated by the existence of a long time series of data collected in a consistent way for the Yellow-footed Rock-wallaby and for birds. We took advantage of this long-term dataset to test the application of two methods of evaluating monitoring results, with a view to developing approaches that might be used to evaluate datasets from other properties in the AWC estate:

- (i) where analysis showed that rainfall was a useful predictor of trends in abundance, we compared the most recent results with predicted values based on a rainfall model;
- (ii) in other cases, where rainfall did not predict trends in abundance, we determined whether the recent results were within the predicted range of values based on observed variation in the baseline data.

The abundance of Yellow-footed Rock-wallaby was strongly associated with rainfall. Abundance declined over the 2018–19 drought, but has since stabilised, indicating that the population may be recovering with improved rainfall. Nevertheless, abundance was at the lower end of the expected range in 2022, potentially reflecting the impacts of threatening processes. The Yellow-footed Rock-wallaby is predated by the introduced fox (*Vulpes vulpes*) and feral cat (*Felis catus*), and competes for food with feral goats (*Capra hircus*) as well as a native herbivore, the Euro (*Osphranter robustus*). Management of threats is critical to the persistence of Yellow-footed Rock-wallabies on Buckaringa. Survey results show that foxes and feral cats have been maintained at low-moderate densities on the sanctuary, but the Euro population has increased over the past five years. Over the same period, populations of two other macropods, the Western Grey Kangaroo (*Macropus fuliginosus*) and Red Kangaroo (*Osphranter rufus*), have declined.

Standard Bird Survey results were a focus of Ecohealth Monitoring in 2022. Results were evaluated in the light of long-term data, using rainfall as a predictor where significant, otherwise in relation to observed patterns of variation. In summary, 2022 results for some species and guilds were within predictions from baseline variation. However, many species and guilds were below predicted levels of abundance and/ or richness, and hence of conservation concern. In more detail:

- the reporting rate (an index of abundance) of seven of 15 individual bird species, the reporting rate of the diurnal bird guild, and the richness of the ground-active bird guild were all **within baseline**. The threatened Southern Whiteface was one of the bird species that were relatively abundant at Buckaringa in 2022;
- in contrast, the richness and reporting rates of honeyeaters and woodland birds, the richness of diurnal birds, the reporting rate of ground-active birds, and the reporting rate of eight of 15 individual bird species, were all **below baseline** (in fact, six of the eight individual bird species were **not detected** in 2022 surveys). Of these, the absence of the Purple-backed Fairy-wren (*Malurus assimilis*) and Inland Thornbill (*Acanthiza apicalis*) is of particular concern, as data show a long-term decline. Woodland birds are generally threatened in southern Australia due to loss and degradation of habitat. While habitat is being managed for conservation at Buckaringa, the severe 2018–19 drought has reduced the abundance several species, with some yet to recover.

Detections of mammal, bird, reptile and frog species on Buckaringa over the last five years generally corresponded with expectations based on survey effort and weather. All 15 mammal species, 102 of 109 terrestrial bird species, 38 of 40 reptile species, and both frog species known to inhabit Buckaringa have been detected since 2018.

Contents

Introduction.....	1
AWC's Ecohealth Monitoring Program	1
Scope of this report	1
2022 weather	2
Methods and effort	3
Analysis and evaluation	5
Rainfall model.....	6
Control chart	6
Confidence levels	6
Results and evaluation	7
Threatened vertebrates	7
Yellow-footed Rock-wallaby.....	7
Vertebrate assemblages and component guilds and species	7
Mammals.....	7
Birds.....	8
Reptiles.....	13
Frogs	13
Threat indicators	13
Feral predators.....	13
Feral herbivores.....	13
Synthesis.....	15
Yellow-footed Rock-wallaby.....	15
Mammal, bird, reptile and frog assemblages	15
Bird guilds and surveillance species	15
Threats.....	16
Acknowledgments	17
References	17
Appendices	19
Appendix 1. Survey history.....	19
Appendix 2. Responses of indicators to rainfall and year	20
Appendix 3. Vertebrate species list.....	22

Document citation: Sitters H, Joseph L, Bellchambers K, Crisp H, Ross A, Kanowski J (2023) Buckaringa Wildlife Sanctuary Ecohealth Report for 2022. Australian Wildlife Conservancy, Perth, WA.

Authorship of this report does not imply support for any particular conservation practice.

Introduction

The mission of Australian Wildlife Conservancy (AWC) is the effective conservation of Australian wildlife and their habitats. AWC relies on information provided by an integrated program of monitoring and research to measure progress in meeting its mission, and to improve conservation outcomes on AWC's network of wildlife sanctuaries and land owned or managed by AWC's partners (hereafter 'AWC properties').

AWC's Ecohealth Monitoring Program

The Ecohealth Monitoring Program has been designed to measure and report on the status and trends of species, ecological processes and threats on AWC properties (Kanowski et al. 2018). Data from the monitoring program are used to address the following broad questions relevant to AWC's mission:

- 'are species persisting on a property?'
- 'are habitats being maintained?'
- 'are threats below ecologically-significant thresholds?'

For species of high conservation value, such as threatened and reintroduced species, the monitoring program seeks to obtain more detailed information to assist their conservation management, for example data on survival, recruitment, condition, distribution and/ or population size.

The structure of AWC's Ecohealth Program is as follows:

- At a high level, AWC's *Monitoring and Evaluation Framework* outlines the rationale, structure and scope of the Ecohealth program.
- Based on that guidance, *Ecohealth Monitoring Plans* are developed for AWC's properties. These plans describe the conservation values or 'assets' of each property, the threats to those assets, the monitoring program that will be used to track the status and trend of conservation assets and threats, and how outcomes will be evaluated.
 - For species of high conservation value, detailed monitoring plans are or will be developed in *Translocation Proposals* (e.g., Moore et al. 2022), *Population Management Plans* (e.g., Berry et al. 2021) and *Conservation Management Plans* (e.g., Hayes et al. in prep.).
 - For threats (fire, feral animals, weeds), detailed monitoring plans are or will be developed in property threat management strategies (e.g., Diete et al. 2022).
 - Relevant information from these conservation plans and threat management strategies will be incorporated into property *Ecohealth Monitoring Plans*.
- The outcomes of ecological surveys conducted to implement *Ecohealth Monitoring Plans* are presented in *Ecohealth Reports* and summary *Ecohealth Scorecards*, compiled annually by AWC.

Scope of this report

This document is one of a series of annual Ecohealth Reports for Buckaringa Wildlife Sanctuary (Buckaringa). The report presents data on the status and trends of biodiversity and threat indicators for the surveys conducted in 2022, alongside results from previous years where data are available. We took advantage of long-term data to evaluate results for the Yellow-footed Rock-wallaby (*Petrogale xanthopus*) and birds. We tested the application of two approaches for evaluating results against patterns of variation in the data:

- (i) where analysis showed that rainfall was a useful predictor of trends in abundance, we compared the most recent results with predicted values based on a rainfall model;
- (ii) in other cases, where rainfall did not predict trends in abundance, we constructed a 'control chart' (Burgman et al. 2012) from baseline data, and determined whether recent results were within the predicted range of values based on observed variation in the baseline data.

The companion Ecohealth Scorecard presents indicators, metrics and evaluations in a summary format for all monitoring conducted on the property between 2008 and 2022.

2022 weather

Buckaringa experiences hot, dry summers and mild winters. Average annual rainfall is 278 mm (Figure 1); since 2008, annual rainfall has approximated the long-term average, with the exceptions of a few particularly dry or wet years. Since the end of the 2018–19 drought, rainfall has been slightly above average.

In general, rainfall at Buckaringa is distributed evenly across the year (Figure 2). In 2022 autumn and winter were unusually dry, and spring was unusually wet. Less than 3 mm of rain was recorded in February and March, whereas 170 mm was recorded in September and October. Most surveys on Buckaringa in 2022 were undertaken in dry conditions before the spring rainfall.

Mean monthly maximum and minimum temperatures at the nearby Hawker Weather Station range between 34°C in January to 4°C in July. Mean monthly temperatures in 2022 were close to long-term averages.

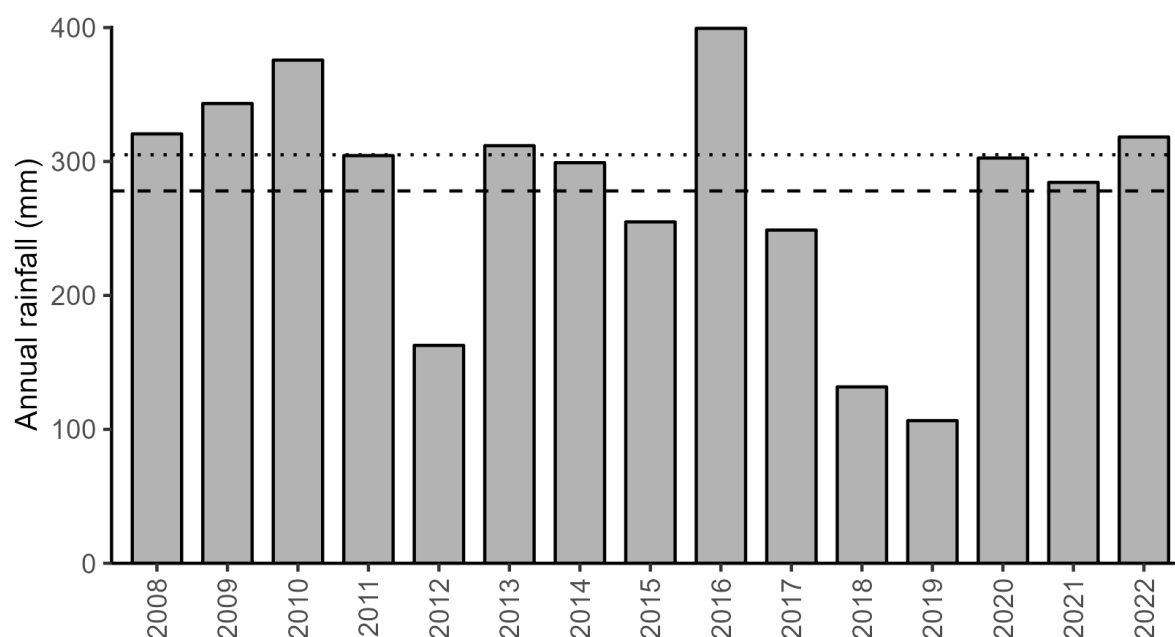


Figure 1. Annual rainfall at Buckaringa, 2008–22. Dashed line = average at Buckaringa, 2008–22; dotted line = average at Hawker Weather Station (ID 019017), 1882–2022. Source: Bureau of Meteorology (2022).

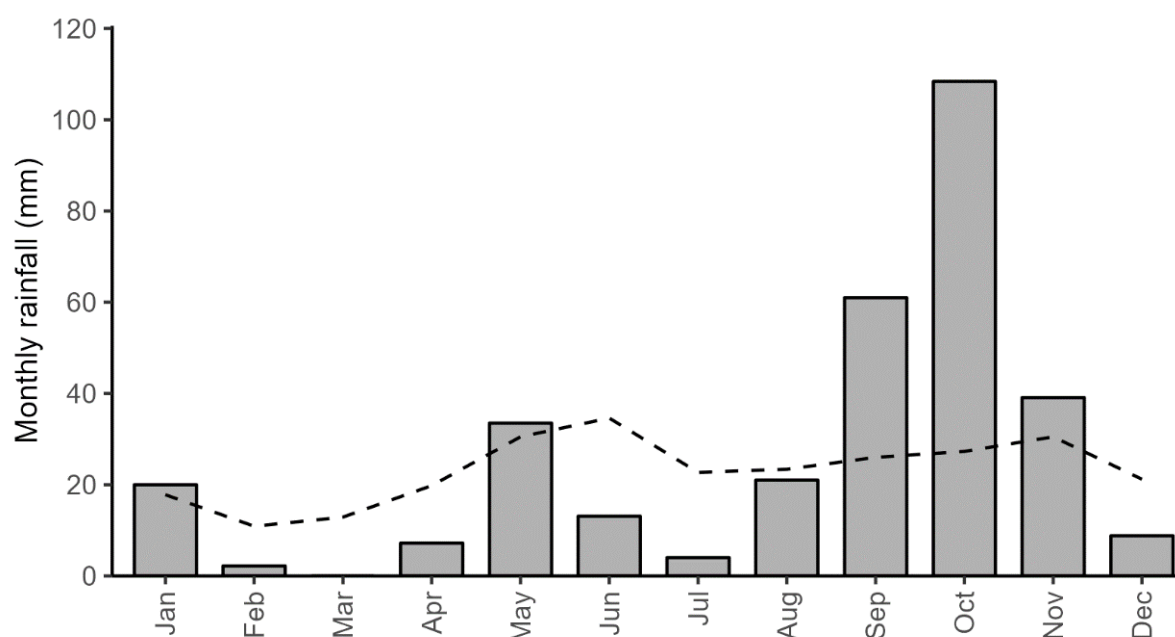


Figure 2. Monthly rainfall at Buckaringa in 2022. Dashed line = average monthly rainfall, 2008–22.

Methods and effort

On Buckaringa, the Ecohealth monitoring program focuses on a species of particular conservation concern, the Yellow-footed Rock-wallaby. Vertebrate assemblages (and their component guilds and species) are subject to surveillance monitoring, as are vegetation and habitat attributes. AWC's Ecohealth program also monitors threats to biodiversity, including fire regimes, introduced predators and herbivores, and weeds.

The rationale behind the selection of biodiversity indicators, detailed information on the design of surveys used to monitor each indicator, and the criteria used to evaluate outcomes for the monitoring program, are provided in the *Buckaringa Ecohealth Monitoring Plan*.

For threats, information on the selection of indicators, survey methods and evaluation criteria is provided in property-level *Conservation Land Management Strategies*, as these are developed for fire, feral animals and weeds, or as otherwise noted in the *Buckaringa Ecohealth Monitoring Plan*.

The biodiversity and threat indicators that were monitored on Buckaringa in 2022 are listed in Tables 1 and 2, along with a summary of the survey methods used to obtain information on each indicator, and the associated survey effort. Survey history is summarised in Appendix 1.

In brief, on Buckaringa in 2022, targeted surveys were conducted for:

- one extant threatened vertebrate

Surveillance monitoring was conducted for:

- three mammals
- three bird guilds and 15 species

Threat metrics were compiled for:

- two introduced predators
- one introduced herbivore

Table 1. Biodiversity indicators monitored on Buckaringa in 2022.

Threatened vertebrates

Species	Survey	Methods summary	2022 effort
Mammals			
Yellow-footed Rock-wallaby (<i>Petrogale xanthopus</i>)	Yellow-footed Rock-wallaby Survey	12 sites surveyed for 1 hour at dawn and 1 hour at dusk on 2 consecutive days. 2 survey rounds. Total effort 96 hours Metric: Abundance = average number of individuals per site	As per summary

Surveillance monitoring of vertebrate assemblages and their component guilds and species

Indicator	Survey	Methods summary	2022 effort
Mammals			
Mammal assemblage	Inventory	Compilation of records over past 5 years from AWC surveys, incidental records and external data verified to AWC standards	As per summary
Large native herbivores			
Western Grey Kangaroo (<i>Macropus fuliginosus</i>) Euro (<i>Osphranter robustus</i>) Red Kangaroo (<i>Osphranter rufus</i>)	Large Herbivore Survey	7.1 km transect driven 5 times through the year (3 times in May, 2 times in November). Total effort 35.5 km Metric: Population estimates derived from the number of animals counted within 40 m of	As per summary

Indicator	Survey	Methods summary	2022 effort
		a 7.1-km transect (57.5 ha); the count per hectare is multiplied by the estimated extent of suitable habitat on the sanctuary (Western Grey Kangaroo 1,500 h; Euro 1,750 ha; Red Kangaroo 750 ha)	
Birds			
Bird assemblage	Inventory	Compilation of records over past 5 years from AWC surveys, incidental records and external data verified to AWC standards	As per summary
Diurnal bird guild Ground-active bird guild Honeyeater guild Woodland guild Individual species: Laughing Kookaburra (<i>Dacelo novaeguineae</i>) Mulga Parrot (<i>Psephotellus varius</i>) Elegant Parrot (<i>Neophema elegans</i>) Purple-backed Fairy-wren (<i>Malurus assimilis</i>) White-winged Fairy-wren (<i>Malurus leucopterus</i>) Singing Honeyeater (<i>Lichenostomus virescens</i>) White-fronted Honeyeater (<i>Purnella albifrons</i>) Weebill (<i>Smicrornis brevirostris</i>) Redthroat (<i>Pyrrholaemus brunneus</i>) Southern Whiteface (<i>Aphelocephala leucopsis</i>) Yellow-rumped Thornbill (<i>Acanthiza chrysorrhoa</i>) Inland Thornbill (<i>Acanthiza apicalis</i>) Chestnut-rumped Thornbill (<i>Acanthiza uropygialis</i>) White-browed Babbler (<i>Pomatostomus superciliosus</i>) Rufous Whistler (<i>Pachycephala rufiventris</i>) Grey Shrike-thrush (<i>Colluricincla harmonica</i>) Willie Wagtail (<i>Rhipidura leucophrys</i>) Red-capped Robin (<i>Petroica goodenovii</i>)	Standard Bird Survey	20-minute, 2-ha survey at 18 sites on 3 consecutive mornings shortly after dawn. Metric: Richness is the mean number of species per site. Reporting rate was calculated as an index of abundance, where the reporting rate at a site in a given year was the proportion of replicate surveys during which the guild or species was detected	54 surveys (18 sites × 3 repeats)
Reptiles			
Reptile assemblage	Inventory	Compilation of records over past 5 years from AWC surveys, incidental records and external data verified to AWC standards	As per summary

Indicator	Survey	Methods summary	2022 effort
Frogs			
Frog assemblage	Inventory	Compilation of records over past 5 years from AWC surveys, incidental records and external data verified to AWC standards	As per summary

Table 2. Threat indicators monitored on Buckaringa in 2022.

Indicator	Survey	Methods summary	2022 effort
Introduced animals			
Fox (<i>Vulpes vulpes</i>) Feral cat (<i>Felis catus</i>)	Feral Predator Survey	20.5 km spotlight transect Metric: average number of individuals recorded per km of transect	102.5 km (5 repeat transects surveys)
Feral goat (<i>Capra hircus</i>)	Large Herbivore Survey	7.1 km transect driven 5 times through the year (3 times in May, 2 times in November). Total effort 35.5 km Metric: Population estimates derived from the number of animals counted from a 7.1-km transect (57.5 ha); the count per hectare is multiplied by the estimated extent of suitable habitat on the sanctuary (2,085 ha). Because goats have a large flush distance, all animals observed from the transect were included, rather than those seen within 40 m	As per summary

Analysis and evaluation

As noted previously, to assist with the interpretation of the survey data, results for the Yellow-footed Rock-wallaby and all bird indicators were evaluated against patterns of variation observed in long-term data. The 2022 (or most recent) data were compared with predicted values based on a rainfall model, where rainfall was shown to be a significant predictor, or with predicted variation using a 'control chart' approach (see below). Outcomes were categorised as above, within, or below baseline, or as not detected (Table 3). The first two evaluation categories are considered positive or neutral; the last two evaluation categories raise concern for the conservation status of the relevant species or guild. Category definitions are intended to ensure adequate sensitivity to declines, and minimise false alarms.

Borderline cases occurred when the standard errors associated with observed and predicted values abutted each other in 2022 (rainfall model approach) or the 2022 metric lay on the boundary between the within and below baseline categories (control chart approach). In these cases, we assigned the below baseline category if there was a statistically significant decline over time, and the within baseline category if there was no overall change in the metric since surveys began.

Table 3. Categories used in evaluation of results, given patterns of variation in long-term data.

Category	Rainfall model definitions	Control chart definitions
Above baseline	The metric value in the year of evaluation is higher than predicted given annual rainfall (no overlap in standard errors)	The metric value in the year of evaluation lies above two standard errors of the mean of the first 10 years of data
Within baseline	The metric value in the year of evaluation is similar to predicted values given annual rainfall (standard errors overlap)	The metric value in the year of evaluation lies within two standard errors of the mean of the first 10 years of data

Below baseline	The metric value in the year of evaluation is lower than predicted given annual rainfall (no overlap in standard errors)	The metric value in the year of evaluation lies below two standard errors of the mean of the first 10 years of data
Not detected	The indicator has not been detected in the year of evaluation	The indicator was not detected in the year of evaluation

Rainfall model

Relationships between each metric and rainfall were tested using a generalised additive mixed model using data from all years except 2022, and results are summarised in Appendix 2. If a metric was related to rainfall ($P \leq 0.05$), predictions from the rainfall model were used to compare the observed metric in 2022 with the expected value based on annual rainfall (Table 3).

Control chart

For metrics where a linear relationship with rainfall was not established ($P > 0.05$), evaluation was conducted using a 'control chart' approach (as per Burgman et al. 2012), where the mean ± 2 SE calculated from the first 10 years of data were used to quantify expected patterns of variation in the data (Table 3).

Confidence levels

Given the method of evaluating results is predicated on quantifying baseline patterns of variation, our confidence in categorising outcomes varies with the length of the baseline dataset. Arbitrarily, we considered that baseline datasets at least 10 years long (or equivalent, such as data collected every second year for 20 years) provided 'adequate' confidence for evaluation, with lower confidence levels generally applied to shorter periods. However, confidence in evaluating outcomes for shorter time periods may be higher where there is evidence of a new or intensifying driver of change in the metric of interest. For example, we would have greater confidence in calling out a decline in a small mammal, given limited baseline data, if the decline coincided with increase in the density of feral predators, their primary threat. Conversely, we would have greater confidence in calling out an increase in a woodland bird, given limited baseline data, if the increase coincided with the restoration of woodland habitat on a property.

For Buckaringa, an 'adequate' confidence level was determined for all evaluated metrics in 2022 because the time series for determining baseline patterns of variation comprised at least 10 annual surveys (Table 4).

Table 4. Confidence levels for evaluation assessments.

Confidence level	Number of annual surveys	Evidence of new or intensifying driver of change?
Adequate	> 10	
	6–10	Yes
Somewhat adequate	6–10	
	4–5	Yes
Limited	4–5	
	< 4	Yes
Low	< 4	

Results and evaluation

Threatened vertebrates

Yellow-footed Rock-wallaby

On average, the abundance of Yellow-footed Rock-wallabies over 13 years of survey on Buckaringa was 5.4 individuals/site (± 0.5 SE), ranging from a high of 9.3 individuals/site in 2011 (± 2.4 SE) to a low of 3.2 individuals/site in 2021 (± 1.0 SE). A strong positive association between abundance and rainfall of the previous year is evident for this species (Appendix 2). Generally, abundance has declined over the survey period (Figure 3; Appendix 2). There appears to have been a step-change in abundance with the severe drought of 2018–19: average abundance was 5.8 individuals/site from 2010–18, and fell to 3.4 individuals/site in 2021–22. The population was not surveyed in 2019 and 2020, when the effect of reduced rainfall was expected to have been most pronounced. However, the abundance of rock-wallabies in 2021 was lower than predicted based on the rainfall model (Table 3), implying long-term impacts from the severe drought. It is possible that predators, competitors or reduced fitness associated with small population size may have limited recovery of rock-wallabies over that period.

In 2022, the abundance of rock-wallabies increased (Figure 3), with observed results overlapping predicted abundance based on the rainfall model. Consequently, abundance in 2022 was categorised as ‘within baseline’.

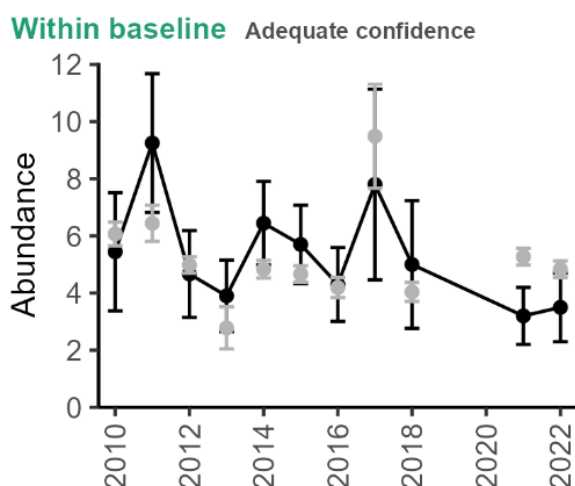


Figure 3. Yellow-footed Rock-wallaby abundance at Buckaringa, 2010–22. Mean abundance (number of individuals per site) is shown ± 1 SE (black points and bars). Grey points and error bars (± 1 SE) show predicted abundance based on a rainfall model (see text).

Vertebrate assemblages and component guilds and species

Mammals

Fifteen native mammals are confirmed on Buckaringa (Appendix 3): the Echidna (*Tachyglossus aculeatus*), two dunnarts (*Sminthopsis* spp.), the Yellow-footed Rock-wallaby and three other macropods, one mouse (Bolam's Mouse, *Pseudomys bolami*) and seven microbats. All species have been recorded on the sanctuary within the last five years.

Macropods

Across much of southern Australia, kangaroos and other large macropods are thought to exist in much higher numbers than at the time of European colonisation, due to the cessation of Indigenous hunting, the persecution of Dingoes, and the addition of artificial watering points for stock. Abundant populations of large macropods can have substantial impacts on the condition, composition and regeneration of native vegetation (Cheal 1986; Gardiner 1986a, b; Grice and Barchia 1992; Nelson 1998; Coulson 1998), with knock-on consequences for native wildlife (e.g., dePruce and Axford 2006; Howland et al. 2014) and for ecosystem processes such as erosion (Waters et al. 2017). These impacts are often additional to those imposed by introduced herbivores, so that in areas where large kangaroos are abundant, the complete removal of

introduced herbivores will not necessarily result in improvements to vegetation condition, and in fact may still result in land degradation. As a consequence, large macropod species are managed on Buckaringa to reduce long-term damage to the native vegetation and ensure the continued survival of ecologically significant and other wildlife species, as per the terms of AWC policy.

Population estimates for Western Grey Kangaroo (*Macropus fuliginosus*) and Red Kangaroo (*Osphranter rufus*) decreased between 2019 and 2022 (Figure 4). In contrast, the population of Euro (*O. robustus*) almost tripled during the same period. However, based on count data (an index of population size), numbers of Euros are still below levels reached from 2009–2017.

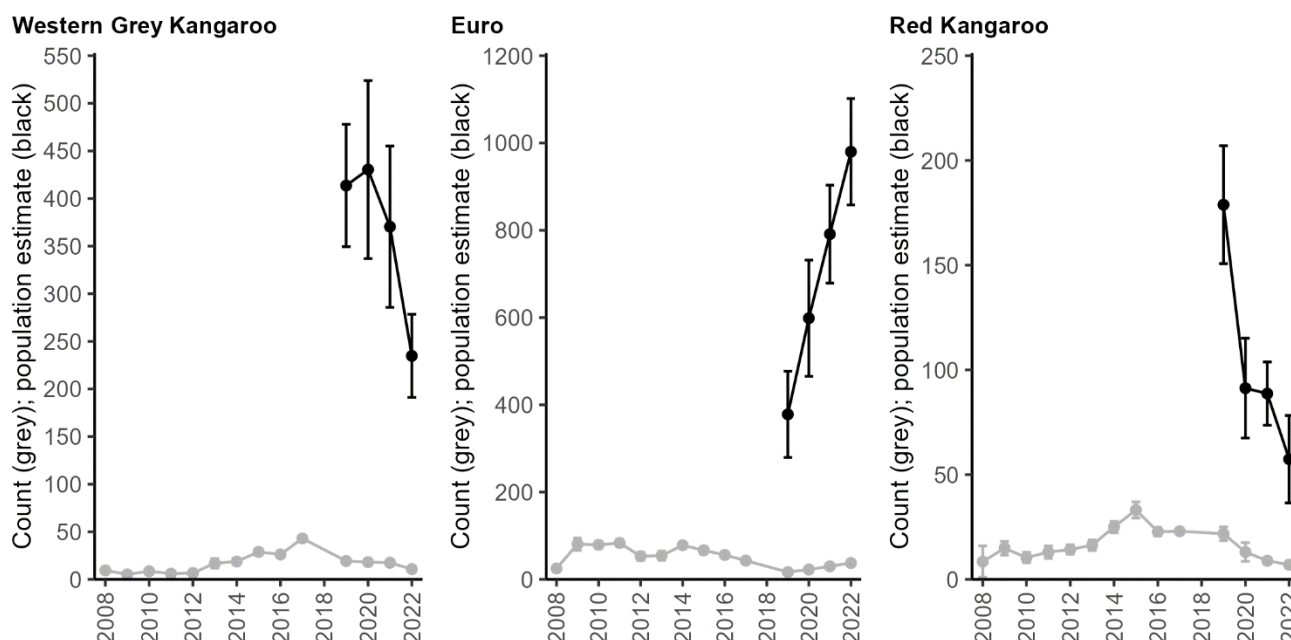


Figure 4. Population estimates (black) for large macropods at Buckaringa, 2008–22. Error bars are ± 1 SE. To enable comparison with previous years count data (grey) are provided; these are the average number of animals counted from transects each year.

Birds

In total, 109 bird species are confirmed for Buckaringa (Appendix 3). Between 2018 and 2022, 102 species were detected on the sanctuary. The seven species that were missed comprised five edge-of-range species (including Yellow-tailed Black Cockatoo, *Zanda funerea* and Yellow-plumed Honeyeater, *Lichenostomus ornatus*); a locally uncommon species for which there is limited suitable habitat available (Hooded Robin, *Melanodryas cucullata*); and an irregular visitor (Little Woodswallow, *Artamus minor*).

We evaluated 2022 results against predictions from long-term baseline data, using a rainfall model where rainfall was significantly associated with a metric, otherwise using a control chart approach, as discussed. To develop the control chart, the first 10 years of surveys were used to calculate the mean (± 2 SE) of the baseline data. Where a rainfall model was used, survey data from 2009–21 were used to quantify baseline patterns of variation. Analyses were conducted for the diurnal bird assemblage and for three guilds (ground-active birds, honeyeaters, woodland birds), as well as for individual species belonging to a guild where sufficient records were available. Laughing Kookaburra (*Dacelo novaeguineae*) and Weebill (*Smicrornis brevirostris*) do not belong to a guild but were detected sufficiently frequently for evaluation and are suitable indicators.

An important caveat in interpreting results is that the Standard Bird Survey has been undertaken at various times of year at Buckaringa. Surveys generally encompassed the spring-summer period when birds are most active and vocal. However, in 2017, 2021 and 2022, surveys were only undertaken in April. To dampen the effects of seasonality on results, reporting rate was calculated as an index of abundance. In addition, three bird species that had particularly low abundance in 2017, 2021 and 2022 were omitted from the analysis (Chestnut-rumped Thornbill, *Acanthiza uropygialis*, White-fronted Honeyeater, *Purnella albifrons* and Redthroat, *Pyrholaemus brunneus*).

Diurnal bird guild

The diurnal bird assemblage comprises all 91 native terrestrial species detected during bird surveys since 2009. In 2022, the assemblage was evaluated at ‘below baseline’ in terms of species richness, but ‘within baseline’ for reporting rate (Figure 5). Diurnal bird richness has declined overall since 2009 (Appendix 2), and was particularly low in 2019 and 2021.

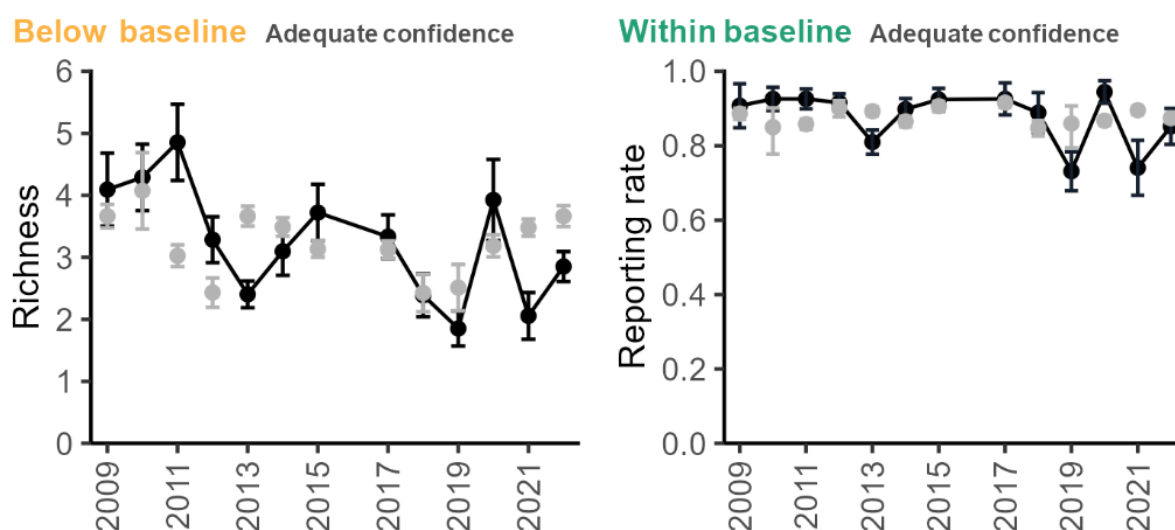


Figure 5. Richness and reporting rate of diurnal birds at Buckaringa, 2009–22. Observed metric values are shown ± 1 SE (black points and bars). Grey points and error bars (± 1 SE) show predicted abundance based on a rainfall model (see text).

Ground-active Guild

In 2022, the richness of the ground-active bird guild was ‘within baseline’, while the reporting rate was ‘below baseline’ (Figure 6). Results associated with individual ground-active species indicated that the decline in reporting rate was driven, in part, by Mulga Parrot (*Psephotellus varius*), Elegant Parrot (*Neophema elegans*) and Purple-backed Fairy-wren (*Malurus assimilis*), none of which were detected during the 2022 Standard Bird Survey (Figure 7). Overall, both the richness and reporting rate of diurnal bird guild declined between 2009 and 2022 (Appendix 2).

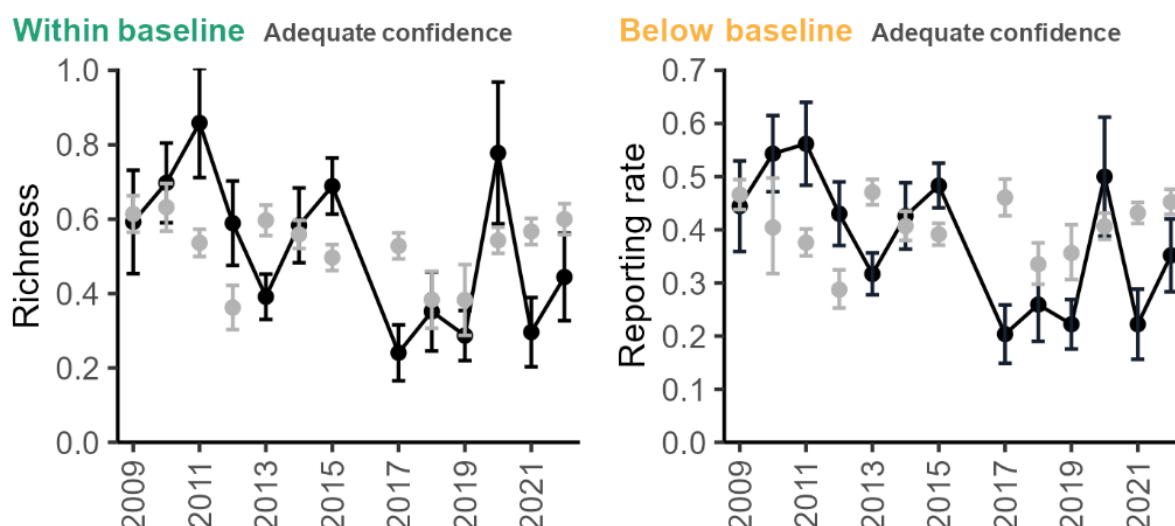


Figure 6. Richness and reporting rate of the ground-active guild at Buckaringa, 2009–22. Observed metric values are shown ± 1 SE (black points and bars). Grey points and error bars (± 1 SE) show predicted abundance based on a rainfall model (see text).

The reporting rate of four ground-active species was 'within/above baseline'; there was no evidence of a decline over time in Southern Whiteface (*Aphelocephala leucopsis*), Yellow-rumped Thornbill (*Acanthiza chrysorrhoa*) or White-browed Babbler (*Pomatostomus superciliosus*), but there has been a decline in the Willie Wagtail (*Rhipidura leucophrys*) reporting rate since 2009 (Figure 7, Appendix 2). However, the Willie Wagtail reporting rate in 2022 represents a pronounced increase from no detections in 2020 and 2021.

The evaluation category of White-winged Fairy-wren (*Malurus leucopterus*) was 'below baseline' in 2022. Of most concern are the Elegant Parrot and Purple-backed Fairy-wren, as the reporting rate for both species has decreased over time and neither species was detected during the surveys on Buckaringa in 2021 or 2022. Elegant Parrot, which has a very large home range, has been recently observed on Buckaringa, however, Purple-backed Fairy-wren potentially may have become locally extinct, although additional surveys are required to confirm this. The Mulga Parrot was seen in large numbers in 2020 and 2021 but was absent in 2022.

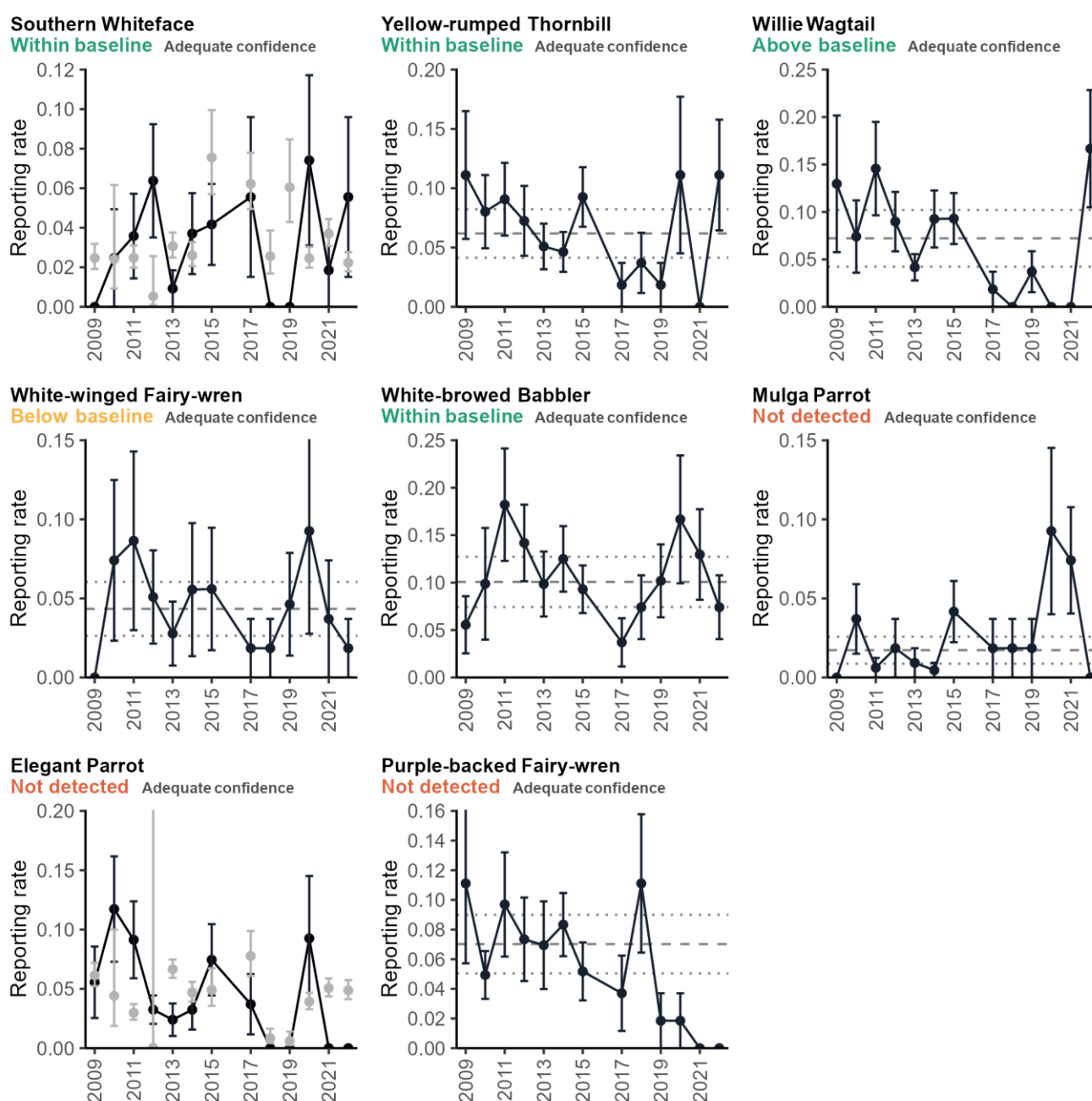


Figure 7. Reporting rate of ground-active species at Buckaringa, 2009–22. Observed metric values are shown ± 1 SE (black points and bars). For Southern Whiteface and Elegant Parrot, grey points and error bars (± 1 SE) show predicted abundance based on a rainfall model (see text). For other species, baseline data calculated from the first 10 annual surveys: dashed horizontal lines = mean; dotted lines = ± 2 SE.

Honeyeater Guild

The richness and reporting rate of the honeyeater guild were ‘below baseline’ in 2022 (Figure 8). Nine honeyeater species have been recorded during Standard Bird Surveys at Buckaringa, but only the Singing Honeyeater (*Lichenostomus virescens*) has been detected frequently enough for evaluation (Figure 9); in 2022, it was ‘within baseline’; its reporting rate has remained reasonably steady since 2010. There is some evidence of an overall decline in both the richness and reporting rate of the honeyeater guild since 2009 (Appendix 2).

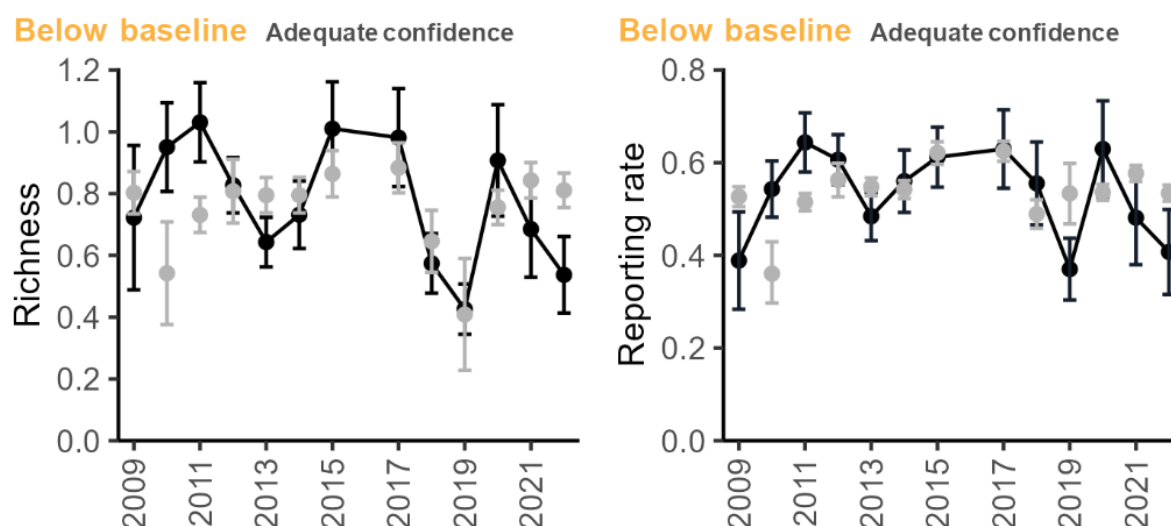


Figure 8. Richness and reporting rate of the honeyeater guild at Buckaringa, 2009–22. Observed metric values are shown ± 1 SE (black points and bars). Grey points and error bars (± 1 SE) show predicted abundance based on a rainfall model (see text).

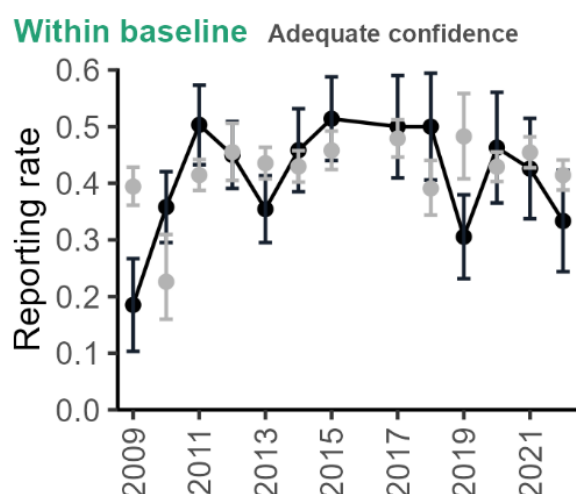


Figure 9. Singing Honeyeater reporting rate at Buckaringa, 2009–22. Observed metric values are shown ± 1 SE (black points and bars). Grey points and error bars (± 1 SE) show predicted abundance based on a rainfall model (see text).

Woodland Guild

The richness and reporting rate of the woodland bird guild were both ‘below baseline’ in 2022 (Figure 10). Nonetheless, two of four woodland indicator species, Grey Shrike-thrush (*Colluricincla harmonica*) and Red-capped Robin (*Petroica goodenovii*), were ‘within baseline’ (Figure 11). The abundance of Grey Shrike-thrush has generally tracked rainfall since 2009; however, the reporting rate of Red-capped Robin has declined (Appendix 2). The reporting rate of the Rufous Whistler (*Pachycephala rufiventris*) was ‘below baseline’ in 2022. Inland Thornbill (*Acanthiza apicalis*) was not detected during Standard Bird Surveys for the first time since they began (Figure 11). Both the richness and reporting rate of the woodland guild has declined since 2009, as has the reporting rate of the Rufous Whistler and Inland Thornbill (Appendix 2).

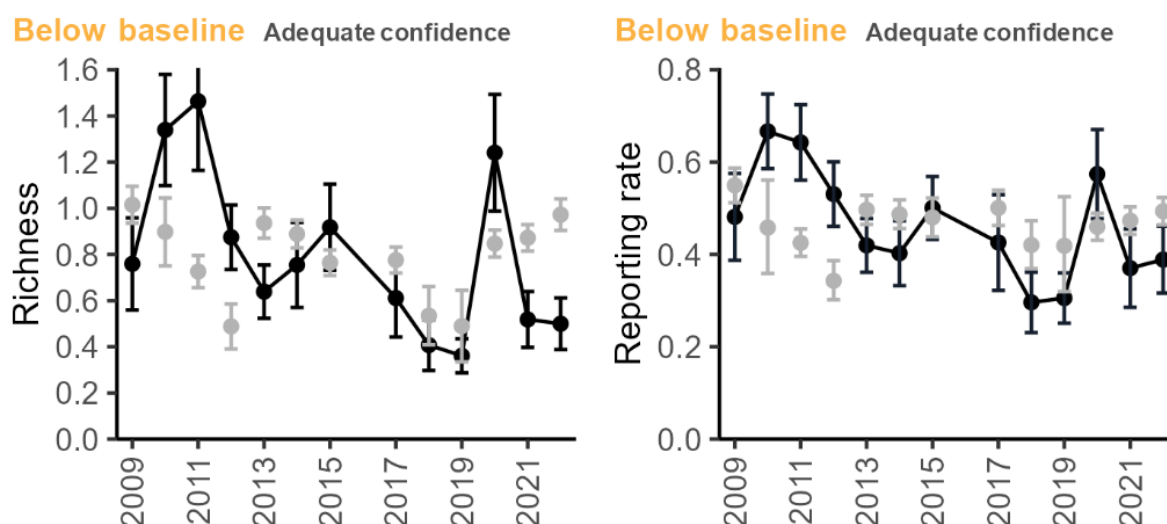


Figure 10. Richness and reporting rate of the woodland guild at Buckaringa, 2009–22. Observed metric values are shown ± 1 SE (black points and bars). Grey points and error bars (± 1 SE) show predicted abundance based on a rainfall model (see text).

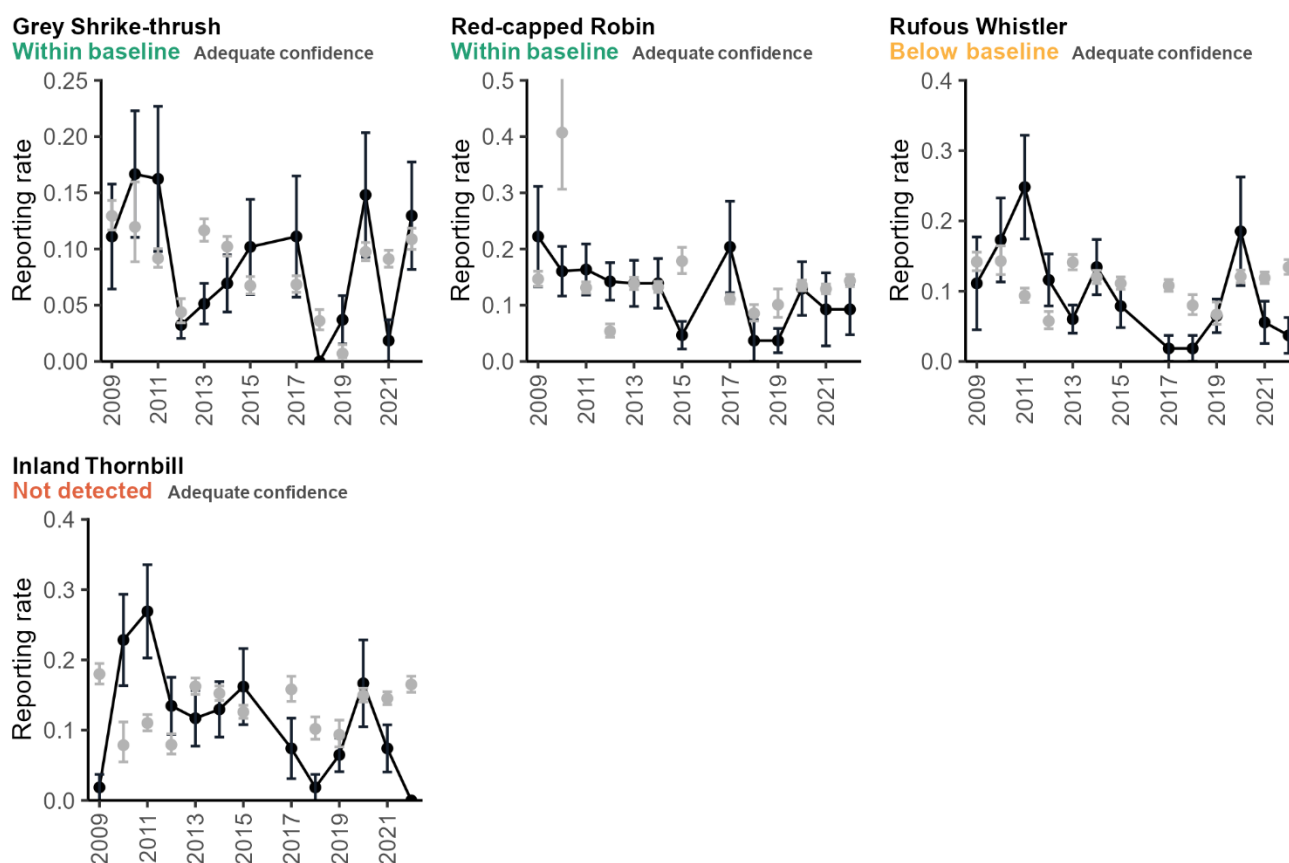


Figure 11. Reporting rate of woodland species at Buckaringa, 2009–22. Observed metric values are shown ± 1 SE (black points and bars). Grey points and error bars (± 1 SE) show predicted abundance based on a rainfall model (see text).

Other bird species

Two well-recognised birds, Laughing Kookaburra and Weebill, have been detected frequently enough for evaluating trends. Neither species was detected during the Standard Bird Survey in 2022 (Figure 12). Laughing Kookaburra has not been detected in Standard Bird Surveys in two successive years, while Weebill was detected frequently in 2021.

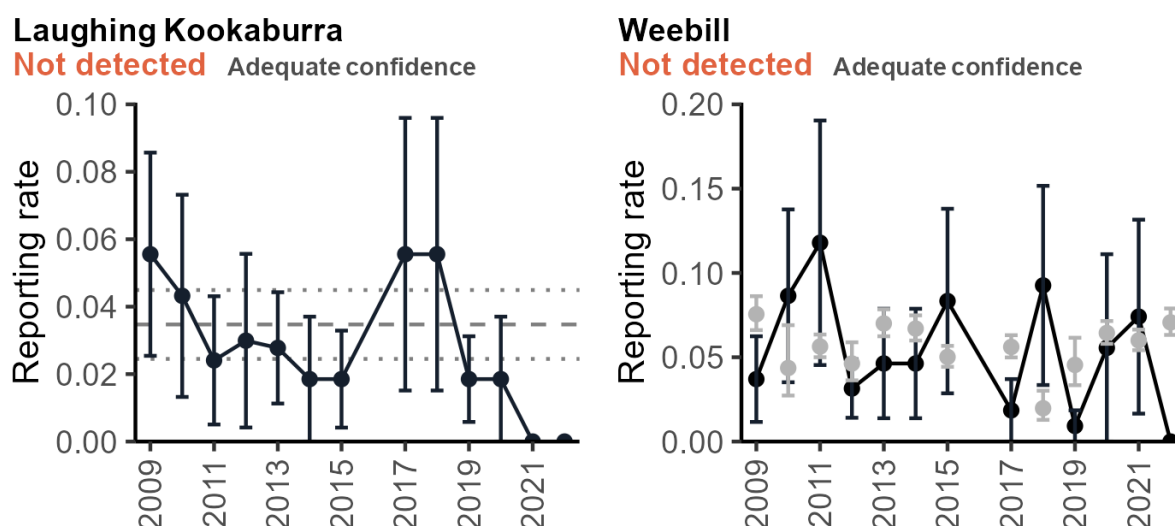


Figure 12. Reporting rate of Laughing Kookaburra and Weebill at Buckaringa, 2009–22. Observed metric values are shown ± 1 SE (black points and bars). For the Weebill, grey points and error bars (± 1 SE) show predicted abundance based on a rainfall model (see text). For the Kookaburra, baseline data calculated from the first 10 annual surveys: dashed horizontal lines = mean; dotted lines = ± 2 SE.

Reptiles

Thirty-eight of the 40 reptile species confirmed to occur at Buckaringa were detected from 2018–2022 (Appendix 3). Most species were detected during the Standard Trapping Survey in 2020. The other two species — Three-lined Knob-tail Gecko (*Nephrurus levis*) and Lazell's Dtella (*Gehyra lazelli*) — have only ever been recorded once prior to 2018.

Frogs

Both frog species confirmed to occur at Buckaringa — Spotted Grass Frog (*Limnodynastes tasmaniensis*) and Northern Flinders Ranges Froglet (*Crinia flindersensis*) — were detected in the last five years (Appendix 3).

Threat indicators

Feral predators

Estimated cat abundance was <0.05 individuals per km of spotlight transect and estimated fox abundance was 0.05 individuals per km, similar to previous years.

Feral herbivores

Estimates of the feral goat population on Buckaringa have ranged from 0–600 between 2009–22 (Figure 13). The estimate of 1,400 individuals obtained in 2008 was derived from only two repeat surveys, and may be unreliable. Population estimates have been reduced by about 50% since 2019.

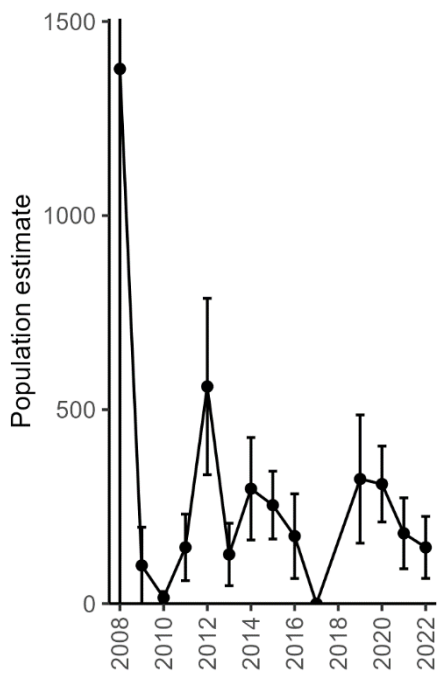


Figure 13. Feral goat population estimates, 2008–22. Error bars are ± 1 SE.

Synthesis

Since acquisition of Buckaringa in 2002, AWC has sought to prevent biodiversity loss on the property, restore animal and plant assemblages, and monitor key conservation assets and threats. In 2022, monitoring targeted the Yellow-footed Rock-wallaby, bird guilds and surveillance species, large native herbivores and introduced species. Here, trends are discussed in the context of environmental drivers and management actions.

Yellow-footed Rock-wallaby

Buckaringa supports an important population of the threatened Yellow-footed Rock-wallaby. Across its range, the species faces a suite of interacting threats, including predation by feral cats and foxes, competition from introduced herbivores and native herbivores, wildfire, and loss of genetic diversity in small populations (e.g., Hayward et al. 2011, Sharp et al. 2014, Potter et al. 2020, Santos et al. 2022).

At Buckaringa, the average site abundance of Yellow-footed Rock-wallaby at Buckaringa has declined over the last 12 years, with a notable drop following the severe 2018–19 drought. Analysis of long-term data showed that the abundance of rock-wallabies was positively associated with rainfall of the previous year. A year's lag between increased rainfall and recruitment was also observed at Buckaringa during an intensive mark-recapture study undertaken from 1979–84, well before AWC's involvement in the property (Robinson et al. 1994). The strength of the relationship between abundance and rainfall in the antecedent year indicates that the Buckaringa population is limited by resource availability.

In 2022, following several years of above-average rainfall, the abundance of Yellow-footed Rock-wallabies on Buckaringa has returned to values predicted by the rainfall model, although observed values were at the lower end of the predicted range. Given the small size of the population, effective management of introduced predators, feral herbivores and overabundant macropods will be required to conserve the population. Further, the population may be particularly vulnerable to any increase in the intensity and/ or duration of droughts driven by climate change (Kirono et al. 2020). AWC will develop a *Conservation Management Plan* for the Yellow-footed Rock-wallaby at Buckaringa, which will consider these issues, and how best to mitigate them. Analysis of the long-term data indicated a decline in abundance beyond the effect of rainfall, underscoring the need for ongoing management of interacting threats on the property.

At Buckaringa, populations of introduced animals are managed and are currently at low–moderate levels. However, numbers of Euros increased over the past few years. Euros can reach high densities in areas adjoining rock-wallaby habitat (Lavery et al. 2021). Plausibly, competition from Euros may reduce the fitness of adult rock-wallabies at Buckaringa and their capacity to successfully rear young, particularly when food is limited. Rock-wallabies are at a competitive disadvantage because they are less able to exploit lowland habitats and must tolerate greater competition for nutritious plants in rugged terrain (Sharp and McCallum 2015). AWC will continue to monitor and manage native herbivore populations at Buckaringa.

Mammal, bird, reptile and frog assemblages

Detections of mammal, bird, reptile and frog species recorded at Buckaringa during the last five years generally met expectations based on survey effort and climatic conditions. All 15 native mammals confirmed to occur at Buckaringa were detected since 2018, including seven microbat species recorded as part of an external research project led by Western Sydney University; while 102 of the 109 terrestrial bird species; 38 of the 40 reptile species, and both frog species, that have been confirmed to occur at Buckaringa, were detected from 2018–22.

Bird guilds and surveillance species

Analysis of 2022 results against patterns of variation in long-term data showed that reporting rates for several species and the diurnal bird assemblage as a whole were 'within baseline', as was the richness of the ground-active bird guild. Species in this category included the threatened Southern Whiteface, which while generally sedentary may move outside its normal range during drought (Higgins and Peter 2002). This species was not detected in bird surveys at the height of the recent drought. One species, the Willie Wagtail, returned an 'above baseline' evaluation in 2022. This species persisted on Buckaringa in very low densities through the drought, and while an increase in abundance in 2022 following two years of average annual rainfall is unsurprising, the magnitude of the increase was remarkable.

However, a larger number of species and guilds returned a 'below baseline' score in 2022. Guilds with 'below baseline' scores for one or both metrics analysed included the diurnal bird assemblage (richness), the ground-active bird guild (reporting rate), and the honeyeater and the woodland bird guilds (both scored 'below baseline' for richness and reporting rate). Species in this category included the White-winged Fairy-wren and Rufous Whistler. On Buckaringa, Rufous Whistler abundance has declined over time, and observed abundance was notably lower than expected abundance given 2022 rainfall. The Rufous Whistler has an extensive range but it is one of many insectivorous woodland birds in decline in southern Australian (Watson 2011). Declines are occurring in both disturbed and intact landscapes, and are linked to degraded habitat as well as an overall decline in rainfall (Stevens and Watson 2013). Several species were not detected at all in 2022 bird surveys, including species that had been reported in the majority of previous years. Of particular concern are Purple-backed Fairy-wren and Inland Thornbill, whose abundance declined steadily between 2009 and 2022. While Purple-backed Fairy-wren is considered stable across its range, the Inland Thornbill is a declining woodland bird (Stevens and Watson 2013).

Threats

Results from 2022 surveys show that feral cat and fox densities remain low at Buckaringa, and goat numbers are currently maintained at moderate levels. These results reflect the efforts of operations staff to limit the impact of threats, as well as some persistent impacts of the severe dry conditions prevailing until 2020.

Acknowledgments

AWC acknowledges the Nukunu Traditional Custodians of the country on which Buckaringa Wildlife Sanctuary resides. We also acknowledge their continuing connection to land, culture and community. We pay our respects to Nukunu Elders past and present.

AWC's Ecohealth Program is only possible because of the generosity of AWC's supporters.

For their assistance in conducting Ecohealth surveys at Buckaringa in 2022, we particularly thank David Wright, Nancy McMurray, Trevor Caldwell, Leon Sherwood and Rhonda Sherwood.

References

- Berry L, Holland G, Anson J, Pierson J, Kanowski J (2021) *Bridled Nailtail Wallaby: Population Management Plan, Scotia Wildlife Sanctuary*. AWC Report, Australian Wildlife Conservancy, Perth, WA.
- Birdlife International (2022) *Aphelocephala leucopsis*. *The IUCN Red List of Threatened Species*. <https://dx.doi.org/10.2305/IUCN.UK.2022-1.RLTS.T22704748A211249958.en>.
- Burgman M, Lowell K, Woodgate P, et al. (2012) An endpoint hierarchy and process control charts for ecological monitoring. In: *Biodiversity Monitoring in Australia* (Eds. D Lindenmayer, P Gibbons) pp. 71-78. CSIRO Publishing, Melbourne.
- Cheal D (1986) A park with a kangaroo problem. *Oryx* 20, 95–99.
- Coulson G (1998) Management of overabundant macropods – Are there conservation benefits? In: *Managing Marsupial Overabundance for Conservation Benefits*. Issues in conservation and management of marsupials. (Ed. PE Cowan) *Occasional Papers of the Marsupial CRC* No. 1. pp 37–48.
- dePreu N, Axford G (2006) *Gawler Ranges National Park macropod management program*. Department for Environment and Heritage, Government of South Australia, Adelaide, SA.
- Diete R, Moore D, Seaton R, Enever G, Kemp J, Jensen R, Kanowski J (2022) *Brooklyn Weed Management Strategy 2022*. AWC Report, Australian Wildlife Conservancy, Perth, WA.
- Gardiner HG (1986a) Dynamics of perennial plants in the mulga (*Acacia aneura* F. Muell.) zone of Western Australia. I. Rates of population change. *Australian Rangeland Journal* 8, 21–28.
- Gardiner HG (1986b) Dynamics of perennial plants in the mulga (*Acacia aneura* F. Muell.) zone of Western Australia. II. Survival of perennial shrubs and grasses. *Australian Rangeland Journal* 8, 28–35.
- Garnett S, Baker G (2021) *The Action Plan for Australian Birds 2020*. CSIRO Publishing, Melbourne.
- Grice AC, Barchia I (1992) Does grazing reduce survival of indigenous perennial grasses of the semi-arid woodlands of western New South Wales? *Australian Journal of Ecology* 17, 195–206.
- Hayes C, Joseph L, L'Hotellier F, Sitters H, Watson A, Kanowski J (in prep.) *Sharman's Rock-wallaby: Conservation Management Plan, Mount Zero-Taravale Wildlife Sanctuary*. Australian Wildlife Conservancy, Perth, WA.
- Hayward MW, Bellchambers K, Herman K, Bentley J, Legge S (2011) Spatial behaviour of yellow-footed rock-wallabies, *Petrogale xanthopus*, changes in response to active conservation management. *Australian Journal of Zoology* 59, 1–8.
- Higgins P, Peter J (2002) *Handbook of Australian, New Zealand and Antarctic Birds. Volume 6: Pardalotes to Shrike-thrushes*. Oxford University Press, Melbourne, Australia.
- Howland B, Stojanovic D, Gordon I, Manning I, Fletcher D, Lindenmayer D (2014) Eaten out of house and home: impacts of grazing on ground-dwelling reptiles in Australian grasslands and grassy woodlands. *PLoS ONE*, 9(12): e105966.
- Lavery TH, Eldridge M, Legge S, Pearson D, Southwell D, Woinarski JCZ, Woolley L-A, Lindenmayer D (2021) Threats to Australia's rock-wallabies (*Petrogale* spp.) with key directions for effective monitoring. *Biodiversity and Conservation* 30, 4137–4161.
- Kanowski J, Joseph L, Kavanagh R, Fleming A (2018) *Designing a monitoring framework for Australian Wildlife Conservancy, a national conservation organisation*. In: Legge S, Lindenmayer D, Robinson N, Scheele B,

- Southwell D, Wintle B (Eds.) *Monitoring Threatened Species and Ecological Communities*, CSIRO Publishing, Melbourne.
- Kanowski J (2009) *Management of Over-Abundant Native Animals Policy*. AWC Report, Australian Wildlife Conservancy, Perth, WA.
- Kanowski J, Bellchambers K, Schofield J, Crisp H (2020) *Minute to Board: Management of overabundant native species at Buckaringa Wildlife Sanctuary*. 14th February 2020. Australian Wildlife Conservancy, Perth, WA.
- Kirono DGC, Round V, Heady C, Chiew FHS, Osbrough S (2020) Drought projections for Australia: Updated results and analysis of model simulations. *Weather and Climate Extremes* 30, 100280.
- Moore D, Skinner K, Anson J, Pierson J, Crisp H, Kanowski J (2022) *Reintroduction of the Central Rock-rat (Zyomys pedunculatus) to Newhaven Wildlife Sanctuary: Translocation Proposal*. AWC Report, Australian Wildlife Conservancy, Perth, WA.
- Nelson L (1998) Kangaroos in the ACT - Urban and rural conflicts and conservation benefits. In: Managing Marsupial Overabundance for Conservation Benefits. Issues in conservation and management of marsupials. (Ed. PE Cowan) *Occasional Papers of the Marsupial CRC* No. 1. pp. 30–36.
- Potter S, Neaves LE, Lethbridge M, Eldridge MDB (2020) Understanding Historical Demographic Processes to Inform Contemporary Conservation of an Arid Zone Specialist: The Yellow-Footed Rock-Wallaby. *Genes* 11, 154.
- Robinson A, Lim L, Cantry P, Jenkins R, MacDonald C (1994) Studies of the yellow-footed rock-wallaby, *Petrogale xanthopus* Gray (Marsupialia: Macropodidae). Population studies at Middle Gorge, South Australia. *Wildlife Research* 21, 473–481.
- Santos JL, Hradsky BA, Keith DA, Rowe KC, Senior KL, Sitters H, Kelly LT (2022) Beyond inappropriate fire regimes: A synthesis of fire-driven declines of threatened mammals in Australia. *Conservation Letters* e12905.
- Sharp A, Norton M, Havelberg C, Cliff W, Marks A (2014) Population recovery of the yellow-footed rock-wallaby following fox control in New South Wales and South Australia. *Wildlife Research* 41, 560–570.
- Sharp A, McCallum H (2015) Bottom-up processes in a declining yellow-footed rock-wallaby (*Petrogale xanthopus celeris*) population: Demography of Decline in a Rock-Wallaby Population. *Austral Ecology* 40, 139–150.
- Stevens HC, Watson DM (2013) Reduced rainfall explains avian declines in an unfragmented landscape: incremental steps toward an empty forest? *Emu - Austral Ornithology* 113, 112–121.
- Waters CM, Orgill SE, Melville GJ, Toole ID, Smith WJ (2017) Management of grazing intensity in the semi-arid rangelands of southern Australia: effects on soil and biodiversity. *Land Degradation and Development* 28, 1363–1375.
- Watson DM (2011) A productivity-based explanation for woodland bird declines: poorer soils yield less food. *Emu - Austral Ornithology* 111, 10–18.

Appendices

Appendix 1. Survey history

Table A1. Summary of survey history for Ecohealth surveys undertaken in 2022.

Survey	Previous surveys
Yellow-footed Rock-wallaby Survey	12 sites surveyed for 1 hour at dawn and 1 hour at dusk on 2 consecutive days. Two surveys per year. Total survey effort per year varied from 44–96 hours: 2021: 96 hours 2017–2018: 48 hours 2013–2016: 96 hours 2012: 64 hours 2011: 44 hours 2010: 92 hours
Large Herbivore Survey	7.1-km transect driven from 2–8 times per year: 2021: 35.5 km (5 repeat surveys) 2020: 42.6 km (6 repeat surveys) 2019: 14.2 km (2 repeat surveys) 2016: 35.5 km (5 repeat surveys) 2015: 42.6 km (6 repeat surveys) 2014: 42.6 km (6 repeat surveys) 2013: 42.6 km (6 repeat surveys) 2012: 49.7 km (7 repeat surveys) 2011: 56.8 km (8 repeat surveys) 2010: 49.7 km (7 repeat surveys) 2009: 49.7 km (7 repeat surveys)
Standard Bird Survey	20-minute, 2-ha survey at 18 sites on 3 consecutive mornings shortly after dawn. Surveys were repeated in some years: 2021: 54 bird surveys (1 survey round) 2020: 54 bird surveys (1 survey round) 2019: 108 bird surveys (2 survey rounds) 2018: 54 bird surveys (1 survey round) 2017: 54 bird surveys (1 survey round) 2015: 216 bird surveys (4 survey rounds) 2014: 216 bird surveys (4 survey rounds) 2013: 216 bird surveys (4 survey rounds) 2012: 216 bird surveys (4 survey rounds) 2011: 162 bird surveys (3 survey rounds) 2010: 162 bird surveys (3 survey rounds) 2009: 54 bird surveys (1 survey round)
Feral Predator Survey	20.5-km spotlight transect driven from 3–14 times per year: 2021: 82.0 km (4 repeat surveys) 2020: 61.5 km (3 repeat surveys) 2019: 82.0 km (4 repeat surveys) 2018: 61.5 km (3 repeat surveys) 2017: 164.0 km (8 repeat surveys) 2016: 143.5 km (7 repeat surveys) 2015: 205.0 km (10 repeat surveys) 2014: 246.0 km (12 repeat surveys) 2013: 287.0 km (14 repeat surveys) 2012: 164.0 km (8 repeat surveys) 2011: 287.0 km (14 repeat surveys) 2010: 287.0 km (14 repeat surveys) 2009: 164.0 km (8 repeat surveys)

Appendix 2. Responses of indicators to rainfall and year

Table A2. Responses of indicators to rainfall, and changes in indicators over time while accounting for the effects of rainfall. P values associated with model coefficients are displayed with a measure of model fit (R^2 ; note that fit applies to the full model, which included survey site). Relationships between indicators and rainfall may be linear or non-linear; only linear responses to year were examined to avoid over-fitting.

Indicator	Metric	Explanatory variable	Response shape	P value	R^2
Mammals					
Yellow-footed Rock-wallaby	Abundance				0.62
		Total rainfall in the year before surveys	Positive	0.005	
		Year	Weak negative	0.072	
Birds					
Diurnal birds	Richness				0.53
		Total rainfall in the year of surveys	Positive	0.002	
		Year	Negative	<0.001	
Diurnal birds	Reporting rate				0.25
		Total rainfall in the year of surveys	Positive	<0.001	
		Year	NA	0.107	
Ground-active Guild					
Ground-active Guild	Richness				0.23
		Total rainfall in the year of surveys	Positive	0.038	
		Year	Negative	0.013	
Ground-active Guild	Reporting rate				0.30
		Total rainfall in the year of surveys	Positive	0.003	
		Year	Negative	<0.001	
Southern Whiteface	Reporting rate				0.21
		Total rainfall in the year of surveys	Positive	0.040	
		Year	NA	0.722	
Yellow-rumped Thornbill	Reporting rate				0.30
		Total rainfall in the year of surveys	Weak positive	0.081	
		Year	NA	0.238	
Willie Wagtail	Reporting rate				0.20
		Total rainfall in the year of surveys	NA	0.101	
		Year	Weak negative	0.053	
White-winged Fairy-wren	Reporting rate				0.70
		Total rainfall in the year of surveys	NA	0.608	
		Year	NA	0.280	
White-browed Babbler	Reporting rate				0.37
		Total rainfall in the year of surveys	NA	0.577	
		Year	NA	0.289	
Mulga Parrot	Reporting rate				0.23
		Total rainfall in the year of surveys	NA	0.391	
		Year	Positive	0.020	
Elegant Parrot	Reporting rate				0.39
		Total rainfall in the year of surveys	Positive	0.005	
		Year	Negative	0.027	
Purple-backed Fairy-wren	Reporting rate				0.28
		Total rainfall in the year of surveys	NA	0.207	
		Year	Negative	<0.001	
Honeyeater Guild					

Indicator	Metric	Explanatory variable	Response shape	P value	R ²
Honeyeater Guild	Richness				0.49
		Total rainfall in the year of surveys	Hump-shaped	0.001	
		Year	Weak negative	0.056	
Honeyeater Guild	Reporting rate				0.52
		Total rainfall in the year of surveys	Hump-shaped	<0.001	
		Year	Weak negative	0.069	
Singing Honeyeater	Reporting rate				0.54
		Total rainfall in the year of surveys	Hump-shaped	0.007	
		Year		0.684	
Woodland Guild					
Woodland Guild	Richness				0.45
		Total rainfall in the year of surveys	Positive	0.002	
		Year	Negative	0.001	
Woodland Guild	Reporting rate				0.57
		Total rainfall in the year of surveys	Positive	<0.001	
		Year	Negative	<0.001	
Grey Shrike-thrush	Reporting rate				0.43
		Total rainfall in the year of surveys	Positive	<0.001	
		Year	NA	0.695	
Red-capped Robin	Reporting rate				0.35
		Total rainfall in the year of surveys	Positive	<0.001	
		Year	Negative	0.002	
Rufous Whistler	Reporting rate				0.46
		Total rainfall in the year of surveys	Positive	<0.001	
		Year	Negative	<0.001	
Inland Thornbill	Reporting rate				0.49
		Total rainfall in the year of surveys	Positive	0.004	
		Year	Negative	<0.001	
Other indicator species					
Laughing Kookaburra	Reporting rate				0.65
		Total rainfall in the year of surveys	NA	0.478	
		Year	Negative	0.046	
Weebill	Reporting rate				0.69
		Total rainfall in the year of surveys	Positive	0.005	
		Year	Weak negative	0.064	

Appendix 3. Vertebrate species list

Table A3. Vertebrate species list for Buckaringa. Likelihood: Confirmed (C), Likely (L), Extinct locally (X). Yes = record. Species in **bold** are newly confirmed records for the property in this reporting period. Threatened status derived from the Commonwealth Government's Environment Protection and Biodiversity Conservation (EPBC) Act 1999.

A. Mammals

Common name	Scientific name [#]	Likelihood	Detected in 2022?	Detected 2018–22?	Comment
Short-beaked Echidna	<i>Tachyglossus aculeatus</i>	C	Yes	Yes	
Narrow-nosed Planigale	<i>Planigale tenuirostris</i>	L			Not confirmed for Buckaringa
Fat-tailed Dunnart	<i>Sminthopsis crassicaudata</i>	C		Yes	
Little Long-tailed Dunnart	<i>Sminthopsis dolichura</i>	L			Not confirmed for Buckaringa
Stripe-faced Dunnart	<i>Sminthopsis macroura</i>	C		Yes	
Common Dunnart	<i>Sminthopsis murina</i>	L			Not confirmed for Buckaringa
Common Brushtail Possum	<i>Trichosurus vulpecula</i>	L			Not confirmed for Buckaringa
Yellow-footed Rock-wallaby	<i>Petrogale xanthopus</i>	C	Yes	Yes	Subspecies <i>P. xanthopus xanthopus</i> occurring in SA and NSW listed as Vulnerable by the Commonwealth Government
Western Grey Kangaroo	<i>Macropus fuliginosus</i>	C	Yes	Yes	
Euro, Common Wallaroo	<i>Osphranter robustus</i>	C	Yes	Yes	
Red Kangaroo	<i>Osphranter rufus</i>	C	Yes	Yes	
Central Short-tailed Mouse, Anoola	<i>Leggadina forresti</i>	L			Not confirmed for Buckaringa
Bolam's Mouse, Poonta	<i>Pseudomys bolami</i>	C		Yes	
Yellow-bellied Sheath-tailed Bat	<i>Saccolaimus flaviventris</i>	L			Not confirmed for Buckaringa
White-striped Free-tailed Bat	<i>Austronomus australis</i>	C	Yes	Yes	
Inland Free-tailed Bat	<i>Ozimops petersi</i>	C	Yes	Yes	
Southern Free-tailed Bat	<i>Ozimops planiceps</i>	L			Not confirmed for Buckaringa
Gould's Wattled Bat	<i>Chalinolobus gouldii</i>	C	Yes	Yes	
Chocolate Wattled Bat	<i>Chalinolobus morio</i>	C	Yes	Yes	
Lesser Long-eared Bat	<i>Nyctophilus geoffroyi</i>	C	Yes	Yes	
Inland Broad-nosed Bat	<i>Scotorepens balstoni</i>	L			Not confirmed for Buckaringa
Inland Forest Bat	<i>Vespadelus baverstocki</i>	C	Yes	Yes	
Finlayson's Cave Bat, Inland Cave Bat	<i>Vespadelus finlaysoni</i>	C	Yes	Yes	
Southern Forest Bat	<i>Vespadelus regulus</i>	L			Not confirmed for Buckaringa
Dingo	<i>Canis familiaris</i>	L			Not confirmed for Buckaringa

[#]Taxonomic source: Australasian Mammal Taxonomy Consortium's Australian Mammal Species List Version 2.0, November 2022.

B. Birds

Common name	Scientific name [#]	Likelihood	Detected in 2022?	Detected 2018–22?	Comment
Emu	<i>Dromaius novaehollandiae</i>	C	Yes	Yes	
Stubble Quail	<i>Coturnix pectoralis</i>	C		Yes	
Pink-eared Duck	<i>Malacorhynchus membranaceus</i>	C			Limited habitat (occurs in shallow, temporary wetlands)
Maned Duck	<i>Chenonetta jubata</i>	C		Yes	
Hardhead	<i>Aythya australis</i>	L			Not confirmed for Buckaringa
Pacific Black Duck	<i>Anas superciliosa</i>	C		Yes	
Grey Teal	<i>Anas gracilis</i>	C		Yes	
Australasian Grebe	<i>Tachybaptus novaehollandiae</i>	C		Yes	
Hoary-headed Grebe	<i>Poliocephalus poliocephalus</i>	L			Not confirmed for Buckaringa
Common Bronzewing	<i>Phaps chalcoptera</i>	C	Yes	Yes	
Crested Pigeon	<i>Ocyphaps lophotes</i>	C	Yes	Yes	
Diamond Dove	<i>Geopelia cuneata</i>	C	Yes	Yes	
Peaceful Dove	<i>Geopelia placida</i>	C	Yes	Yes	
Tawny Frogmouth	<i>Podargus strigoides</i>	C	Yes	Yes	
Spotted Nightjar	<i>Eurostopodus argus</i>	C		Yes	
Australian Owlet-nightjar	<i>Aegotheles cristatus</i>	C	Yes	Yes	
Pacific Swift	<i>Apus pacificus</i>	L			Not confirmed for Buckaringa
Horsfield's Bronze Cuckoo	<i>Chalcites basalis</i>	C		Yes	
Black-eared Cuckoo	<i>Chalcites osculans</i>	C		Yes	
Shining Bronze Cuckoo	<i>Chalcites lucidus</i>	L			Not confirmed for Buckaringa
Fan-tailed Cuckoo	<i>Cacomantis flabelliformis</i>	C		Yes	
Pallid Cuckoo	<i>Heteroscenes pallidus</i>	C		Yes	
Black-tailed Native-hen	<i>Tribonyx ventralis</i>	C			Limited habitat (occurs in temporary wetlands)
Australian Bustard	<i>Ardeotis australis</i>	C		Yes	
Yellow-billed Spoonbill	<i>Platalea flavipes</i>	C			Limited habitat (occurs in the shallows of wetlands)
White-necked Heron	<i>Ardea pacifica</i>	L			Not confirmed for Buckaringa
Great Egret	<i>Ardea alba</i>	L			Not confirmed for Buckaringa
White-faced Heron	<i>Egretta novaehollandiae</i>	C		Yes	
Little Black Cormorant	<i>Phalacrocorax sulcirostris</i>	C			Limited habitat (common in smaller rivers and lakes)
Black-fronted Dotterel	<i>Elsayornis melanops</i>	L			Not confirmed for Buckaringa
Banded Lapwing	<i>Vanellus tricolor</i>	L			Not confirmed for Buckaringa
Masked Lapwing	<i>Vanellus miles</i>	L			Not confirmed for Buckaringa
Little Button-quail	<i>Turnix velox</i>	C		Yes	
Eastern Barn Owl	<i>Tyto alba</i>	C	Yes	Yes	

Australian Boobook	<i>Ninox boobook</i>	C	Yes	Yes	
Black-shouldered Kite	<i>Elanus axillaris</i>	C		Yes	
Wedge-tailed Eagle	<i>Aquila audax</i>	C	Yes	Yes	
Little Eagle	<i>Hieraaetus morphnoides</i>	C		Yes	
Swamp Harrier	<i>Circus approximans</i>	L			Not confirmed for Buckaringa
Spotted Harrier	<i>Circus assimilis</i>	C		Yes	
Brown Goshawk	<i>Accipiter fasciatus</i>	C		Yes	
Collared Sparrowhawk	<i>Accipiter cirrocephalus</i>	C		Yes	
Whistling Kite	<i>Haliastur sphenurus</i>	C		Yes	
Black Kite	<i>Milvus migrans</i>	C	Yes	Yes	
Rainbow Bee-eater	<i>Merops ornatus</i>	C		Yes	
Sacred Kingfisher	<i>Todiramphus sanctus</i>	C		Yes	
Red-backed Kingfisher	<i>Todiramphus pyrrhopygius</i>	C		Yes	
Laughing Kookaburra	<i>Dacelo novaeguineae</i>	C	Yes	Yes	
Nankeen Kestrel	<i>Falco cenchroides</i>	C	Yes	Yes	
Australian Hobby	<i>Falco longipennis</i>	C		Yes	
Brown Falcon	<i>Falco berigora</i>	C	Yes	Yes	
Grey Falcon	<i>Falco hypoleucos</i>	L			Not confirmed for Buckaringa. Listed as Vulnerable by the Commonwealth Government
Black Falcon	<i>Falco subniger</i>	C		Yes	
Peregrine Falcon	<i>Falco peregrinus</i>	C		Yes	
Cockatiel	<i>Nymphicus hollandicus</i>	C		Yes	
Yellow-tailed Black Cockatoo	<i>Zanda funerea</i>	Outside range			A single vagrant recorded at Buckaringa
Galah	<i>Eolophus roseicapilla</i>	C	Yes	Yes	
Major Mitchell's Cockatoo	<i>Cacatua leadbeateri</i>	L			Not confirmed for Buckaringa
Little Corella	<i>Cacatua sanguinea</i>	C	Yes	Yes	
Sulphur-crested Cockatoo	<i>Cacatua galerita</i>	L			Not confirmed for Buckaringa
Red-rumped Parrot	<i>Psephotus haematonotus</i>	C			Buckaringa is outside the core range
Bluebonnet	<i>Northiella haematogaster</i>	L			Not confirmed for Buckaringa
Mulga Parrot	<i>Psephotellus varius</i>	C	Yes	Yes	
Crimson Rosella	<i>Platycercus elegans</i>	C	Yes	Yes	
Australian Ringneck	<i>Barnardius zonarius</i>	C	Yes	Yes	
Blue-winged Parrot	<i>Neophema chrysostoma</i>	C			Buckaringa is outside the core range.
Elegant Parrot	<i>Neophema elegans</i>	C	Yes	Yes	
Purple-crowned Lorikeet	<i>Glossopsitta porphyrocephala</i>	L			Not confirmed for Buckaringa
Budgerigar	<i>Melopsittacus undulatus</i>	C	Yes	Yes	
Brown Treecreeper	<i>Climacteris picumnus</i>	L			Not confirmed for Buckaringa
Purple-backed Fairy-wren	<i>Malurus assimilis</i>	C	Yes	Yes	

Splendid Fairy-wren	<i>Malurus splendens</i>	L			Not confirmed for Buckaringa
White-winged Fairywren	<i>Malurus leucopterus</i>	C	Yes	Yes	
Short-tailed Grasswren	<i>Amytornis merrotsyi</i>	L			Not confirmed for Buckaringa. Vulnerable according to the Commonwealth Government at subspecies level (Flinders Ranges Short-tailed Grasswren, <i>A. merrotsyi merrotsyi</i>)
Brown-headed Honeyeater	<i>Melithreptus brevirostris</i>	C		Yes	
White-eared Honeyeater	<i>Nesoptilotis leucotis</i>	C		Yes	
Black Honeyeater	<i>Sugomel nigrum</i>	C		Yes	
Pied Honeyeater	<i>Certhionyx variegatus</i>	C		Yes	
Tawny-crowned Honeyeater	<i>Gliciphila melanops</i>	C		Yes	
Crimson Chat	<i>Epthianura tricolor</i>	C		Yes	
White-fronted Chat	<i>Epthianura albifrons</i>	C	Yes	Yes	
Orange Chat	<i>Epthianura aurifrons</i>	C		Yes	
Spiny-cheeked Honeyeater	<i>Acanthagenys rufogularis</i>	C	Yes	Yes	
Red Wattlebird	<i>Anthochaera carunculata</i>	C		Yes	
Singing Honeyeater	<i>Gavicalis virescens</i>	C	Yes	Yes	
White-plumed Honeyeater	<i>Ptilotula penicillata</i>	C	Yes	Yes	
Yellow-plumed Honeyeater	<i>Ptilotula ornata</i>	C			Buckaringa is outside the core range
Grey-fronted Honeyeater	<i>Ptilotula plumula</i>	C		Yes	
White-fronted Honeyeater	<i>Purnella albifrons</i>	C		Yes	
Yellow-faced Honeyeater	<i>Caligavis chrysops</i>	L			Not confirmed for Buckaringa
Yellow-throated Miner	<i>Manorina flavigula</i>	C	Yes	Yes	
Spotted Pardalote	<i>Pardalotus punctatus</i>	L			Not confirmed for Buckaringa
Striated Pardalote	<i>Pardalotus striatus</i>	C	Yes	Yes	
Weebill	<i>Smicrornis brevirostris</i>	C	Yes	Yes	
Redthroat	<i>Pyrrholaemus brunneus</i>	C		Yes	
Shy Heathwren	<i>Calamanthus cautus</i>	C			Buckaringa is outside the core range
Rufous Fieldwren	<i>Calamanthus campestris</i>	L			Not confirmed for Buckaringa
Southern Whiteface	<i>Aphelocephala leucopsis</i>	C	Yes	Yes	Listed as Vulnerable by the Commonwealth Government
Yellow-rumped Thornbill	<i>Acanthiza chrysorrhoa</i>	C	Yes	Yes	
Yellow Thornbill	<i>Acanthiza nana</i>	C		Yes	
Inland Thornbill	<i>Acanthiza apicalis</i>	C		Yes	
Chestnut-rumped Thornbill	<i>Acanthiza uropygialis</i>	C	Yes	Yes	
White-browed Babbler	<i>Pomatostomus superciliosus</i>	C	Yes	Yes	
Varied Sittella	<i>Daphoenositta chrysoptera</i>	L			Not confirmed for Buckaringa
Crested Bellbird	<i>Oreoica gutturalis</i>	L			Not confirmed for Buckaringa

Gilbert's Whistler	<i>Pachycephala inornata</i>	C		Yes	
Rufous Whistler	<i>Pachycephala rufiventris</i>	C	Yes	Yes	
Golden Whistler	<i>Pachycephala pectoralis</i>	C		Yes	
Grey Shrike-thrush	<i>Colluricincla harmonica</i>	C	Yes	Yes	
Chirruping Wedgebill	<i>Psophodes cristatus</i>	L			Not confirmed for Buckaringa
Ground Cuckooshrike	<i>Coracina maxima</i>	C		Yes	
Black-faced Cuckooshrike	<i>Coracina novaehollandiae</i>	C	Yes	Yes	
White-winged Triller	<i>Lalage tricolor</i>	C		Yes	
Grey Currawong	<i>Strepera versicolor</i>	L			Not confirmed for Buckaringa
Australian Magpie	<i>Gymnorhina tibicen</i>	C	Yes	Yes	
Grey Butcherbird	<i>Cracticus torquatus</i>	C	Yes	Yes	
Masked Woodswallow	<i>Artamus personatus</i>	C		Yes	
White-browed Woodswallow	<i>Artamus superciliosus</i>	C		Yes	
Dusky Woodswallow	<i>Artamus cyanopterus</i>	C		Yes	
Black-faced Woodswallow	<i>Artamus cinereus</i>	C	Yes	Yes	
Little Woodswallow	<i>Artamus minor</i>	C			Irregular visitor
White-breasted Woodswallow	<i>Artamus leucorhyn</i>	L			Not confirmed for Buckaringa
Willie Wagtail	<i>Rhipidura leucophrys</i>	C	Yes	Yes	
Grey Fantail	<i>Rhipidura albiscapa</i>	C		Yes	
Restless Flycatcher	<i>Myiagra inquieta</i>	C		Yes	
Magpie-lark	<i>Grallina cyanoleuca</i>	C		Yes	
Little Crow	<i>Corvus bennetti</i>	C	Yes	Yes	
Little Raven	<i>Corvus mellori</i>	C			Buckaringa is outside the core range
Australian Raven	<i>Corvus coronoides</i>	C	Yes	Yes	
White-winged Chough	<i>Corcorax melanorhamphos</i>	L			Not confirmed for Buckaringa
Apostlebird	<i>Struthidea cinerea</i>	C	Yes	Yes	
Scarlet Robin	<i>Petroica boodang</i>	C		Yes	
Red-capped Robin	<i>Petroica goodenovii</i>	C	Yes	Yes	
Jacky Winter	<i>Microeca fascinans</i>	C		Yes	
Southern Scrub-robin	<i>Drymodes brunneopygia</i>	C	Yes	Yes	
Hooded Robin	<i>Melanodryas cucullata</i>	C			Locally uncommon
Horsfield's Bushlark	<i>Mirafra javanica</i>	L			Not confirmed for Buckaringa
Eurasian Skylark	<i>Alauda arvensis</i>	L			Not confirmed for Buckaringa
Brown Songlark	<i>Cincloramphus cruralis</i>	C		Yes	
Rufous Songlark	<i>Cincloramphus mathewsi</i>	C		Yes	
White-backed Swallow	<i>Cheramoeca leucosterna</i>	L			Not confirmed for Buckaringa
Fairy Martin	<i>Petrochelidon ariel</i>	C		Yes	
Tree Martin	<i>Petrochelidon nigricans</i>	C	Yes	Yes	

Welcome Swallow	<i>Hirundo neoxena</i>	C		Yes	
Silvereye	<i>Zosterops lateralis</i>	C		Yes	
Mistletoebird	<i>Dicaeum hirundinaceum</i>	C		Yes	
Diamond Firetail	<i>Stagonopleura guttata</i>	C		Yes	
Zebra Finch	<i>Taeniopygia castanotis</i>	C		Yes	
Australasian Pipit	<i>Anthus novaeseelandiae</i>	C	Yes	Yes	

#Taxonomic source: *Birdlife Australia working list v4.*

C. Reptiles

Common name	Scientific name [#]	Likelihood	Detected in 2022?	Detected 2018–22?	Comment
Crested Dragon	<i>Ctenophorus cristatus</i>	L			Not confirmed for Buckaringa
Tawny Dragon	<i>Ctenophorus decresii</i>	C		Yes	
Peninsula Dragon	<i>Ctenophorus fionni</i>	L			Not confirmed for Buckaringa
Mallee Military Dragon	<i>Ctenophorus fordi</i>	C		Yes	
Central Netted Dragon	<i>Ctenophorus nuchalis</i>	L			Not confirmed for Buckaringa
Painted Dragon	<i>Ctenophorus pictus</i>	L			Not confirmed for Buckaringa
Red-barred Dragon	<i>Ctenophorus vadrappa</i>	L			Not confirmed for Buckaringa
Nobbi	<i>Diporiphora nobbi</i>	L			Not confirmed for Buckaringa
Central Bearded Dragon	<i>Pogona vitticeps</i>	C	Yes	Yes	
Eyrean Earless Dragon	<i>Tympanocryptis tetraporophora</i>	L			Not confirmed for Buckaringa
Gawler Earless Dragon	<i>Tympanocryptis tolleyi</i>	L			Not confirmed for Buckaringa
Three-lined Knob-tail	<i>Nephrurus levis</i>	C			Opportunistic record > 5 years ago
Thick-tailed Gecko	<i>Underwoodisaurus milii</i>	C		Yes	
Ranges Stone Gecko	<i>Diplodactylus furcosus</i>	C		Yes	
Tessellated Gecko	<i>Diplodactylus tessellatus</i>	C		Yes	
Gibber Gecko	<i>Lucasium byrnei</i>	C		Yes	
Beaded Gecko	<i>Lucasium damaeum</i>	L			Not confirmed for Buckaringa
Eyre Basin Beaked Gecko	<i>Rhynchoedura eyrensis</i>	L			Not confirmed for Buckaringa
Jewelled Gecko	<i>Strophurus elderi</i>	C		Yes	
Southern Spiny-tailed Gecko	<i>Strophurus intermedius</i>	C		Yes	
Marbled Gecko	<i>Christinus marmoratus</i>	L			Not confirmed for Buckaringa
Lazell's Dtella	<i>Gehyra lazelli</i>	C			Opportunistic record > 5 years ago
Purplish Dtella	<i>Gehyra purpurascens</i>	L		Yes	
Eastern Variegated Dtella	<i>Gehyra versicolor</i>	C		Yes	
Bynoe's Prickly Gecko	<i>Heteronotia binoei</i>	C		Yes	
Flinders Ranges Worm-lizard	<i>Aprasia pseudopulchella</i>	L			Not confirmed for Buckaringa. Vulnerable according to EPBC

Marble-faced Delma	<i>Delma australis</i>	C		Yes	
Unbanded Delma	<i>Delma butleri</i>	C		Yes	
Gulfs Delma	<i>Delma malleri</i>	L			Not confirmed for Buckaringa
Burton's Snake-lizard	<i>Lialis burtonis</i>	C		Yes	
Common Scaly-foot	<i>Pygopus lepidopodus</i>	L			Not confirmed for Buckaringa
Western Hooded Scaly-foot	<i>Pygopus nigriceps</i>	C		Yes	
Eastern Hooded Scaly-foot	<i>Pygopus schraderi</i>	C		Yes	
Inland Snake-eyed Skink	<i>Cryptoblepharus australis</i>	L			Not confirmed for Buckaringa
Ragged Snake-eyed Skink	<i>Cryptoblepharus pannosus</i>	C		Yes	
Common Dwarf Skink	<i>Menetia greyii</i>	C		Yes	
Saltbush Morethia Skink	<i>Morethia adelaidensis</i>	L			Not confirmed for Buckaringa
South-eastern Morethia Skink	<i>Morethia boulengeri</i>	C		Yes	
Shrubland Morethia Skink	<i>Morethia obscura</i>	L			Not confirmed for Buckaringa
Olympic Ctenotus	<i>Ctenotus olympicus</i>	L			Not confirmed for Buckaringa
Oriental Ctenotus	<i>Ctenotus orientalis</i>	C		Yes	
Leopard Ctenotus	<i>Ctenotus pantherinus</i>	L			Not confirmed for Buckaringa
Pale-rumped Ctenotus	<i>Ctenotus regius</i>	L			Not confirmed for Buckaringa
Robust Ctenotus	<i>Ctenotus robustus</i>	C		Yes	
Stony-soil Ctenotus	<i>Ctenotus saxatilis</i>	L			Not confirmed for Buckaringa
Barred Wedgesnout Ctenotus	<i>Ctenotus schomburgkii</i>	L			Not confirmed for Buckaringa
Ribbon Ctenotus	<i>Ctenotus taeniatus</i>	L			Not confirmed for Buckaringa
Broad-banded Sand-swimmer	<i>Eremiascincus richardsonii</i>	C		Yes	
Three-toed Earless Skink	<i>Hemiergis decresiensis</i>	L			Not confirmed for Buckaringa
Triodia Earless Skink	<i>Hemiergis millewae</i>	L			Not confirmed for Buckaringa
South-eastern Slider	<i>Lerista bougainvillii</i>	L			Not confirmed for Buckaringa
Southern Slider	<i>Lerista dorsalis</i>	L			Not confirmed for Buckaringa
Edwards' Slider	<i>Lerista edwardsae</i>	L			Not confirmed for Buckaringa
Southern Sandslider	<i>Lerista labialis</i>	C		Yes	
Eastern Robust Slider	<i>Lerista punctatovittata</i>	L			Not confirmed for Buckaringa
Robust Mulch Slider	<i>Lerista terdigitata</i>	L			Not confirmed for Buckaringa
Timid Slider	<i>Lerista timida</i>	C		Yes	
Spinifex Slender Bluetongue	<i>Cyclodomorphus melanops</i>	C		Yes	
Saltbush Slender Bluetongue	<i>Cyclodomorphus venustus</i>	L			Not confirmed for Buckaringa
Gidgee Skink	<i>Egernia stokesii</i>	C		Yes	
Tree Skink	<i>Egernia striolata</i>	C		Yes	
Desert Skink	<i>Liopholis inornata</i>	L			Not confirmed for Buckaringa
Centralian Ranges Rock-skink	<i>Liopholis margaretae</i>	C		Yes	
Southern Sand-skink	<i>Liopholis multiscutata</i>	L			Not confirmed for Buckaringa

Western Blue-tongued Lizard	<i>Tiliqua occipitalis</i>	L			Not confirmed for Buckaringa
Shingle-back	<i>Tiliqua rugosa</i>	C	Yes	Yes	
Eastern Blue-tongued Lizard	<i>Tiliqua scincoides</i>	C		Yes	
Gould's Goanna	<i>Varanus gouldii</i>	C		Yes	
Carpet Python	<i>Morelia spilota</i>	L			Not confirmed for Buckaringa
Southern Blind Snake	<i>Anilius australis</i>	L			Not confirmed for Buckaringa
Dark-spined Blind Snake	<i>Anilius bicolor</i>	L			Not confirmed for Buckaringa
Prong-snouted Blind Snake	<i>Anilius bituberculatus</i>	L			Not confirmed for Buckaringa
Interior Blind Snake	<i>Anilius endoterus</i>	L			Not confirmed for Buckaringa
Coral Snake	<i>Brachyuropsis australis</i>	L			Not confirmed for Buckaringa
Narrow-banded Burrowing Snake	<i>Brachyuropsis fasciolatus</i>	L			Not confirmed for Buckaringa
Yellow-faced Whipsnake	<i>Demansia psammophis</i>	C		Yes	
Red-naped Snake	<i>Furina diadema</i>	C		Yes	
Mulga Snake	<i>Pseudechis australis</i>	C		Yes	
Strap-snouted Brown Snake	<i>Pseudonaja aspidorhyncha</i>	C		Yes	
Western Brown Snake	<i>Pseudonaja mengdeni</i>	C		Yes	
Ringed Brown Snake	<i>Pseudonaja modesta</i>	C		Yes	
Short-tailed Snake	<i>Suta nigriceps</i>	L			Not confirmed for Buckaringa
Spectacled Hooded Snake	<i>Suta spectabilis</i>	L			Not confirmed for Buckaringa
Curl Snake	<i>Suta suta</i>	C		Yes	
Eastern Bandy-bandy	<i>Vermicella annulata</i>	L			Not confirmed for Buckaringa

#Taxonomic source: Australian Society of Herpetologists' Official List of Australian species, June 2022.

D. Frogs

Common name	Scientific name [#]	Likelihood	Detected in 2022?	Detected 2018–22?	Comment
Brown Tree Frog	<i>Litoria ewingii</i>	L			Not confirmed for Buckaringa
Spotted Grass Frog	<i>Limnodynastes tasmaniensis</i>	C	Yes	Yes	
Painted Frog	<i>Neobatrachus pictus</i>	L			Not confirmed for Buckaringa
Sudell's Frog	<i>Neobatrachus sudellae</i>	L			Not confirmed for Buckaringa
Northern Flinders Ranges Froglet	<i>Crinia flindersensis</i>	C	Yes	Yes	
Brown Toadlet	<i>Pseudophryne bibronii</i>	L			Not confirmed for Buckaringa

#Taxonomic source: Australian Society of Herpetologists' Official List of Australian species, June 2022.

Copyright © Australian Wildlife Conservancy 2023

Images © individual photographers and AWC

All images, text and graphics in this Report are protected by copyright law.

Apart from fair dealing for the purpose of private study research, criticism or review, as permitted under the *Copyright Act 1968*, no part of this Report may be reproduced by any process or reused for any purposes whatsoever without prior written permission from AWC.

Enquiries should be made to info@australianwildlife.org