

# Distribution and conservation status of the Rufous Grasswren *Amytornis whitei* on north-eastern Eyre Peninsula and in the Yellabinna, South Australia

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**ABSTRACT** – The Rufous Grasswren *Amytornis whitei* has four subspecies, two of which occur in South Australia, Sandhill Rufous Grasswren *A. w. oweni* in the Great Victoria Desert and Yellabinna Rufous Grasswren *A. w. aenigma* in two disjunct populations in the southern Yellabinna region north of Ceduna and on north-eastern Eyre Peninsula. The Yellabinna Rufous Grasswren is known from fewer than 50 records. On north-eastern Eyre Peninsula, grasswrens have become scarce, and habitat in both regions appears to be in poor condition; the subspecies is consequently of conservation concern. In this study, we review previous records of the Yellabinna Rufous Grasswren and assess its known distribution and conservation status using standard IUCN criteria. Our assessment indicates that it should be classed as Endangered, with a total Area of Occupancy of <500 km<sup>2</sup> and a declining geographic range.

## INTRODUCTION

Recent taxonomic revision recognises three species within the Striated Grasswren *Amytornis striatus* complex: Striated Grasswren *A. striatus sensu stricto* in the south-eastern Australian mallee, Opalton Grasswren *A. rowleyi* in central Queensland and Rufous Grasswren *A. whitei* in Western Australia, Central Australia, and South Australia west of Spencer Gulf (Black *et al.* 2020a). The Rufous Grasswren comprises four subspecies: *A. w. whitei* in the Pilbara, Western Australia, *A. w. oweni* in central and western deserts, including the Great Victoria Desert, and two newly-named subspecies *A. w. parvus* on the Cape Range, North West Cape Peninsula, Western Australia, and *A. w. aenigma* in the southern Yellabinna and north-eastern Eyre Peninsula (Black *et al.* 2020b; Figures 1 and 2).

The last-listed subspecies *A. w. aenigma*, the Yellabinna Rufous Grasswren, here simply Yellabinna Grasswren, is poorly documented. It was included previously in the Striated Grasswren and judged phenotypically transitional between Murray Mallee and Great Victoria Desert populations (Schodde

1982; Schodde and Mason 1999; Figure 3). The subspecies consists of two populations, in the southern Yellabinna north of Ceduna, its type locality, and in the remnant mallee of north-eastern Eyre Peninsula from Pinkawillinie Conservation Park (CP) west of Kimba to Munyaroo CP north of Cowell.

Habitat for Yellabinna Grasswrens resembles that of Striated Grasswrens: sand plain with open mallee over mid and understorey shrubs and hummock grasses (*Triodia* spp.) (Higgins *et al.* 2001; Black *et al.* 2020b; authors pers. obs.). Mallee-*Triodia* habitats are strongly influenced by fire, and many component fauna species are associated with a particular successional stage or require long-unburnt habitat (Woinarski and Recher 1997; Taylor *et al.* 2012). This is likely to be true for the Yellabinna Grasswren, as it is for related *Triodia*-dependant taxa, including Sandhill Rufous Grasswren *A. w. oweni* (Pedler 1991; Reid *et al.* 1993), Striated Grasswren (Connell *et al.* 2017), Short-tailed Grasswren *A. merrotsyi* (Carpenter 2004), Carpentarian Grasswren *A. dorotheae* (Perry *et al.* 2011),

Kalkadoon Grasswren *A. ballarae* (Harrington *et al.* 2017), Mallee Emuwren *Stipiturus mallee* (Brown *et al.* 2009; Connell *et al.* 2017) and Rufous-crowned Emuwren *S. ruficeps* (Woinarski and Recher 1997).

Factors predicting the presence of Striated Grasswrens have been identified as *Triodia* ground cover, *Triodia* height, and extent of shrub cover (Brown 2011; Verdon *et al.* 2020). These habitat characteristics change with time since fire (Haslem *et al.* 2011; Moseby *et al.* 2016). Verdon *et al.* (2020) showed that the best predictors of Striated Grasswren presence were the extent of *Triodia* cover, extent of *Triodia* cover with a height >35 cm, mean *Triodia* height and, to a lesser degree, extent of shrub cover <50 cm high. Carpentarian Grasswrens were found in quadrats with higher percentage cover of *Triodia* 40-60 cm high (Perry *et al.* 2011), and the presence of Short-tailed Grasswrens was correlated positively with cover of *Triodia* and shrubs >25 cm high (Carpenter 2004).

Yellabinna Grasswrens of both populations often co-occur with Sandhill Dunnarts *Sminthopsis psammophila* (J. Read pers. comm.; Brown *et al.* 2014). At dunnart sites, *Triodia* cover was found to peak at about 23 years post fire with 90th percentile *Triodia* height increasing for 20 years and being relatively constant thereafter (Moseby *et al.* 2016), while a study of faunal habitat resources and fire fuel attributes in the Murray Mallee showed a peak in *Triodia* cover at around 20-30 years, before slowly declining (Haslem *et al.* 2011). However, some areas retain good condition *Triodia* long after fire (Moseby *et al.* 2016; J. Read pers. comm.), which may relate to greater water availability and soil nutrients at lower elevations (Verdon *et al.* 2019). Additionally, climatic events, such as drought and severe heat, may affect the condition and succession of *Triodia* adversely (Winkworth 1967; L. Pedler pers. comm.). Striated Grasswrens have a higher probability of occurrence in habitats 20-50 years post-fire (Connell *et al.* 2017), and Rufous Grasswrens in Uluru-Kata Tjuta National

Park (NP) prefer areas not burnt for 15-40 years, but forage in areas more recently burnt if able to retreat into suitable habitat with larger *Triodia* or shrubs nearby (Pedler 1991). Reid *et al.* (1993) attributed the persistence of Rufous Grasswrens at Uluru-Kata Tjuta NP to a vigorous patch-burn strategy, in place for eight years, that protected mature spinifex from wildfires and promoted fine scale landscape mosaics, providing spinifex communities of varying successional states. They recommended further research into fire management to yield prescriptive guidelines on the habitat needs of the species.

Anecdotal information suggests Yellabinna Grasswrens, particularly of the north-eastern Eyre Peninsula population, have become difficult to locate in recent decades, raising concern for the conservation status of the subspecies (Black *et al.* 2020b). In this review, we collate records of Yellabinna Grasswren to assess any change in prevalence over time. We examine the recent distribution of the subspecies and determine its conservation status using standard IUCN criteria.

## METHODS

Records of Yellabinna Grasswrens were obtained from published reports, from the South Australian Museum, South Australian Department for Environment and Water (SA Fauna records), BirdLife Australia, the Atlas of Living Australia, and unpublished observations of several individuals. Records from SA Fauna, BirdLife Australia and Atlas of Living Australia databases were obtained under a data licence agreement from the South Australian Department for Environment and Water which precludes reporting of localities with a precision finer than 10 km. This was because the Striated Grasswren, as it was then named, was regarded as a 'sensitive species'.

Where possible we checked primary sources of information by examining biological survey reports and museum data, and by contacting

individuals who had provided records. We attempted to locate the records accurately despite considerable variation, some giving a notional distance (e.g. from Whyalla), a reliability of 5 km or more, others a precise GPS-determined position.

We assessed the conservation status of the Yellabinna Grasswren according to standard criteria (IUCN 2012) using Extent of Occurrence (EOO) and Area of Occupancy (AOO). EOO is the minimum convex polygon which encompasses all known sites [= total distribution], and AOO is the area of actual or inferred presence. In the absence of comprehensive data, we calculated AOO by a default IUCN method, as used in studies of Carpentarian Grasswrens (Harrington and Murphy 2015), by placing a 2x2 km grid over each known record locality. EOO and AOO analyses were undertaken using GeoCAT (Geospatial conservation assessment tool [geocat.kew.org]; Bachman *et al.* 2011).

We addressed a subset of additional determining variables (IUCN 2012) relating to population fragmentation: number of locations, and continuing decline in EOO, AOO, in number of locations, subpopulations or mature individuals, or in area or quality of habitat. Here location is defined as a distinct area in which a single threatening event can rapidly affect all individuals, such as a large bushfire.

We present recent incidental observations from sites of previous grasswren records, as well as preliminary data from an ongoing field study that commenced in 2020, including an assessment of habitat condition. The methodology of the field study is modified from Black *et al.* (2009) and will be described fully in a later paper.

## RESULTS

We collated 30 records of Yellabinna Grasswren on north-eastern Eyre Peninsula between 1926

and 2017 (Figure 1, Table 1), and 17 records in the Yellabinna area north of Ceduna between 1983 and 2020 (Figure 2, Table 2).

North-eastern Eyre Peninsula records were clustered in nine general areas. At least two records were from farmland now largely cleared of native vegetation, the first from near Kimba and one near Pine Hill (Figure 1, Table 1). There is also a record of the 'Striated Fieldwren' (= Rufous Fieldwren *Calamanthus campestris*) in *Triodia* in Hincks CP in the 1968 Nature Conservation Society of South Australia survey report (Preiss and Thomas 1970). Fieldwrens do not usually occupy *Triodia* so the report could conceivably be of a grasswren, but there are no other reports of grasswrens from the vicinity and we therefore regard it as uninterpretable and unlikely.

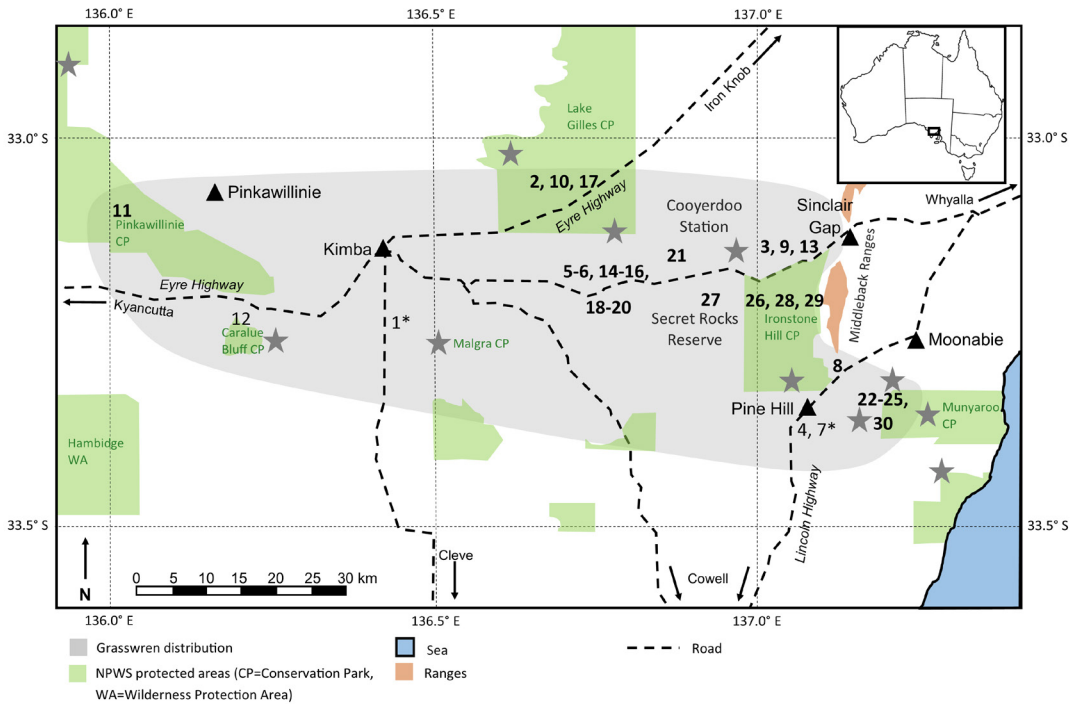
The first specimen of Yellabinna Grasswren from north-eastern Eyre Peninsula was taken by F. E. Parsons in 1926 near a locality 'Kelly', about eight miles (13 km) south of Kimba (SAOA 1926). We found no subsequent record until 1972, and between then and 2002 most records were near a 40 km stretch of the Whyalla to Kimba road between Sinclair Gap in the Middleback Range and a little west of Secret Rocks Reserve. More recently, reports of this Eyre Peninsula population have decreased and we obtained only two in the last decade, both from the east of its known range (B. Backhouse, pers. comm.; KJ, pers. obs.; Figure 1, Table 1). Subsequently, we failed to detect grasswrens during private trips and field surveys between 2019-2021, despite visiting all sites in Figure 1 except Kelly (record 1), Pine Hill (record 4) and Caralue Bluff (record 12). Nor have we found any at two potential sites on Cooyerdoo Station, four in or near Lake Gilles CP, one in Pinkawillinie CP, three in Munyaroo CP and four on surrounding properties, one in Caralue Bluff CP and one in Malgra CP (Figure 1). We observed that *Triodia* in these areas is generally in marginal or poor condition having limited ground cover, small *Triodia* size and moderate to high levels of senescence. Only six

or seven sites had good or very good condition *Triodia*. Between 2017 and 2021 habitat in Ironstone Hill CP and Munyaroo CP has shown progressive senescence, with *Triodia* in some areas appearing completely dead (KJ pers. obs.).

Of the Yellabinna records, the first recorded observation was on Goog’s Track by a group that included Lynn Pedler and AB in 1983 (Black *et al.* 2020b). There have been few records since and only six in the last decade (Table 2, Figure 2), concentrated on Goog’s Track but over a smaller area than inferred from records between 1983 and 2007, and much habitat appeared in poor condition in August 2019 (AB, GC pers. obs.). Because the area is remote and access is limited, it is possible that the Yellabinna population is larger than is presently known. Pureba CP

and other areas of the Yellabinna region might conceal grasswrens, although KJ and GC found none in 2020 at five sites in the eastern part of Pureba CP containing habitat resembling that along Goog’s Track.

The two identified Yellabinna Grasswren populations are separated by about 260 km, but it is unknown whether they were continuous before agricultural development of northern Eyre Peninsula and fragmentation of its native vegetation (DEWNR 2014). If both populations are combined, the EOO = 28,799 km<sup>2</sup> and AOO = 144 km<sup>2</sup>. If considered individually, the EOO = 2,194 km<sup>2</sup> and AOO = 56 km<sup>2</sup> for the Yellabinna population, and EOO = 2,432 km<sup>2</sup> and AOO = 88 km<sup>2</sup> for the Eyre Peninsula population.



**Figure 1.** Distribution of Yellabinna Rufous Grasswren on north-eastern Eyre Peninsula, South Australia, derived from known records. Numbers indicate approximate locations of records listed in Table 1. Bold numbers show sites searched by the authors in 2020, while stars indicate additional areas of potentially suitable habitat searched. \* indicates record known from or likely from an area now cleared of native vegetation.

**Table 1.** Yellabinna Rufous Grasswren records from north-eastern Eyre Peninsula, South Australia.

\* indicates record known from or likely from an area now cleared of native vegetation.

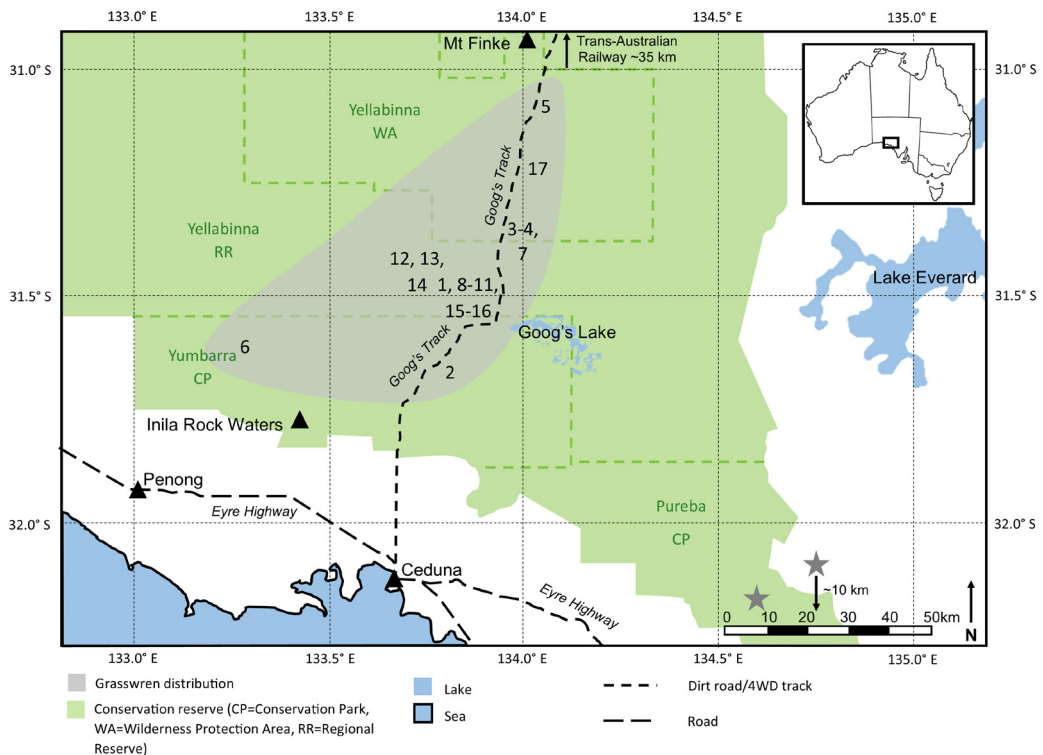
Date	Observer/s	Record number	Locality	Reference/ Museum Accession number
29/4/1926	F. E. Parsons	1*	Kelly, S of Kimba	SAOA (1926); SAMA B23396
1972	R. and F. Stephens	2	Lake Gilles CP	Stephens and Stephens (1972)
14/4/1972	R. J. Swaby	3	Sinclair Gap	Swaby (1972)
30/12/1972	J. B. Cox	4	Pine Hill	Cox (1974)
4/1/1974	H. J. Eckert	5	Secret Rocks area	SAMA B57484
4/1/1974	H. J. Eckert	6	Secret Rocks area	SAMA B57485
15/7/1975	L. P. Pedler	7*	Pine Hill	Reid (1976)
21/12/1975	J. B. Cox	8	S of Middleback Range	Reid (1976); SAMA B29409
10/1976	D. Close	9	Sinclair Gap	Reid (1980)
21/10/1976	D. Close	10	Lake Gilles CP	Reid (1980)
21/11/1976	N. C. H. Reid	11	Pinkawillinie CP	SAMA B30560, B30559; Reid (1980)
10/1977	T. Cox	12	Caralue Bluff	Pers. comm. to GC
18/10/1981	L. P. Pedler	13	Sinclair Gap	SAMA B34109
13/6/1988	R. Kernot	14	Secret Rocks area	SAOA (1988)
13/6/1988	G. Carpenter	15	Secret Rocks area	GC pers. obs.
31/8/1992	T. Cox	16	Secret Rocks area	Pers. comm. to GC
29/5/1994	G. Carpenter and J. Matthew	17	Lake Gilles CP	GC pers. obs.
mid-1990s	D. Harper	18	Secret Rocks area	Pers. comm. to KJ
3/9/2000	L. P. Pedler	19	Secret Rocks area	SAMA B55486
2/12/2002	L. P. Pedler and J. Cooper	20	Secret Rocks area	Brandle (2010)
2/12/2002	L. P. Pedler and J. Cooper	21	Cooyerdoo Station	Brandle (2010)
28/11/2005	G. Carpenter	22	Munyaroo	GC pers. obs.; Carpenter in Thomas (2011)
2/12/2005	G. Carpenter	23	Munyaroo	GC pers. obs.
2/12/2005	G. Carpenter	24	Munyaroo	GC pers. obs.
2/12/2005	G. Carpenter	25	Munyaroo	GC pers. obs.
15/5/2008	B. Blaylock	26	Ironstone Hill CP	Shirrococ Management Plan Survey. Department for Environment and Heritage, South Australia, Adelaide.; ALA
Unknown	J. Read	27	Secret Rocks Reserve	Pers. comm. to KJ
Unknown	J. Read	28	Ironstone Hill CP	Pers. comm. to KJ
10/2014	B. Backhouse	29	Ironstone Hill CP	Pers. comm. to KJ
11/12/2017	K. Jones	30	Munyaroo	KJ pers. obs.

ALA = Atlas of Living Australia [[www.ala.org.au](http://www.ala.org.au)]; CP = Conservation Park; SAMA = South Australian Museum, Adelaide.

In order to categorise a taxon of restricted geographic range according to IUCN criteria, two other variables must be addressed (IUCN 2012), in this case, the number of 'locations' and evidence for continuing decline. The number of 'locations', in which a single threatening event can rapidly affect all individuals of the taxon, can be considered by comparing the EOO with the size of bushfires in the region. Within the last 20 years, three of the larger fires in the Yellabinna burnt 616 km<sup>2</sup> (January 2001), 1,418 km<sup>2</sup> (November 2012) and 1,214 km<sup>2</sup> (January 2014 fire complex; DEWNR 2016), suggesting that the number of 'locations' is 2-4. If the EOO for each population is summed and divided by the largest area burnt (i.e. 2,194 + 2,432 km<sup>2</sup> = 4,626 km<sup>2</sup>/1,418 km<sup>2</sup>) the number of locations is 3.3. If only the Yellabinna population were to

survive the number of locations would then be 1.7 (i.e. 2,432 km<sup>2</sup>/1,418 km<sup>2</sup>). The Eyre Peninsula population has not been located recently despite dedicated searches throughout its known range. The status of the Yellabinna population is currently unclear, although recently it has been located only west and north of Goog's Lake. Ongoing decline in EOO and AOO is therefore evident.

The AOO for the Yellabinna Grasswren is <500 km<sup>2</sup> (criterion B2), it is known to exist at no more than five locations (criterion B2a) and there is a continuing decline in AOO (criterion B2b(ii)). The subspecies is therefore deemed Endangered under IUCN criteria B2ab(ii) (Black *et al.* 2021; IUCN 2012).



**Figure 2.** Distribution of Yellabinna Rufous Grasswren in the Yellabinna region, South Australia, derived from known records. Numbers indicate approximate locations of records listed in Table 2 and stars indicate additional areas with potentially suitable habitat searched by the authors in 2020.

**Table 2.** Yellabinna Rufous Grasswren records from the Yellabinna region, South Australia.

Date	Observer/s	Record number	Locality	Reference/ Museum Accession number
21/8/1983	L. P. Pedler	1	Yellabinna RR	Pers. comm. to AB
21/8/1983	L. P. Pedler	2	Yumbarra CP	SAMA B37658
22/8/1983	L. P. Pedler	3	Yellabinna RR	Pers. comm. to AB
22/8/1983	L. P. Pedler	4	Yellabinna WA	Pers. comm. to AB
22/8/1983	L. P. Pedler	5	Yellabinna WA	Pers. comm. to AB
29/3/1995	L. P. Pedler	6	Yumbarra CP	Owens <i>et al.</i> (1995)
18/5/1999	Birds Australia	7	Yellabinna WA	Birds Australia; ALA
3/6/2007	C. Curson	8	Yellabinna RR	Birddata/BirdLife; ALA
11, 12/8/2007	L. Joseph	9	Yellabinna RR	ANWC B52250, B52262
12/8/2007	L. P. Pedler and I. Mason	10	Yellabinna RR	ANWC B52263
12/8/2007	I. Mason and L. P. Pedler	11	Yellabinna RR	ANWC B52270
5/2017	B. Backhouse	12	Yellabinna RR	Pers. comm. to KJ
5/2017	B. Backhouse	13	Yellabinna RR	Pers. comm. to KJ
5/2017	B. Backhouse	14	Yellabinna RR	Pers. comm. to KJ
5/2019	B. Backhouse	15	Yellabinna RR	Pers. comm. to KJ
26/7/2020	K. Jones	16	Yellabinna RR	KJ pers. obs.
28/7/2020	K. Jones	17	Yellabinna WA	KJ pers. obs.

ALA = Atlas of Living Australia [[www.ala.org.au](http://www.ala.org.au)]; ANWC = Australian National Wildlife Collection, Canberra; CP = Conservation Park; RR = Regional Reserve; SAMA = South Australian Museum, Adelaide; WA = Wilderness Protection Area.

## DISCUSSION

This review of Yellabinna Grasswren records indicates that this subspecies has a very limited distribution within mallee-*Triodia* habitat in two populations separated by about 260 km. Most of the reports from north-eastern Eyre Peninsula are confined to a small (40 km) section of the Whyalla to Kimba road west of Sinclair Gap. This population has not been reported since 2017 and has not been located during extensive searches since 2019. Records of the Yellabinna population are also confined to a limited part of the Yellabinna region near Goog's Lake, although recent records indicate that small numbers still occur in this area. This population is likely to extend into adjacent mallee-*Triodia* habitat, where access is limited, but the extent of vegetation clearance across northern Eyre Peninsula has largely isolated the two populations (DEWNR 2014).

## AOO, EOO and conservation status

This study shows that, while the EOO for the combined disjunct populations of Yellabinna Grasswrens is 28,799 km<sup>2</sup>, its AOO of only 144 km<sup>2</sup> has declined and it occurs in few locations, so that it is assessed as Endangered, following IUCN criteria.

On north-eastern Eyre Peninsula, there is strong evidence for population decline. The subspecies was last recorded west of and from within Lake Gilles CP in 1977 and 1994, respectively, and at the western extremity of Secret Rocks Reserve and Cooyerdoo Station in 2002 (Table 1, Figure 1). Since then, there have been records only from the reserve itself and from Ironstone Hill and Munyaroo CPs, all near the eastern limit of its distribution, and none during subsequent targeted surveys throughout its known range

(Figure 1). Additionally, none were found in recent years while monitoring Sandhill Dunnart sites where grasswrens were recorded previously (J. Read pers. comm.), or on field trips to eastern Eyre Peninsula by the Port Augusta Bird Group (B. Haase and P. Langdon pers. comm. to AB).

The status of the Yellabinna population is unclear and requires investigation. Recent failure to locate grasswrens at previously known sites, where habitat now appears in poor condition, is cause for concern.

The apparent poor condition of grasswren habitat is suggested by widespread senescence of *Triodia* which, though developing variably over time in healthy mallee systems (Moseby *et al.* 2016; Verdon *et al.* 2019), appears to have occurred prematurely on Eyre Peninsula recently. The nine most recent records (records 22-30; Table 1, Figure 1) were in or near the location of a November 1990 bushfire which

included the western part of Munyaroo CP, western slopes of the Middleback Range and a large portion of Ironstone Hill CP (DEWNR 2016). This was 31 years ago, a year past the peak *Triodia* ground cover period in the Murray Mallee (Haslem *et al.* 2011) and 8 years past that for Sandhill Dunnart sites (Moseby *et al.* 2016). Yet, some sites in the Murray Mallee maintained cover of tall, >45 cm high, *Triodia* for over 100 years post fire (Verdon *et al.* 2019). Additionally, 31 years post-fire is in the midrange of post-fire ages where Striated Grasswrens have a higher probability of occurrence (20-50 years; Connell *et al.* 2017), and of post-fire ages that are preferred by Rufous Grasswrens in Central Australia (15-40 years; Pedler 1991). It might therefore have been expected that *Triodia* would be in relatively good condition, but there are areas in Ironstone Hill CP where it is almost completely dead, and most has died at the site of the last known record near Munyaroo CP (authors pers. obs.). Only a few sites within the burnt area



**Figure 3.** Yellabinna Rufous Grasswren *Amytornis whitei aenigma* male, Yellabinna Regional Reserve north-west of Goog's Lake, July 2020. The evenly-toned cinnamon underparts may be an under-appreciated trait of the species. Image Colin Rogers



retain average condition *Triodia*. The reason for this deterioration is unknown; a period of low rainfall and/or changes in climate may be pertinent. Temperatures have been exceptional over much of the continent in the years 2013 to 2019 inclusive, including over the Yellabinna and Eyre Peninsula where 12-monthly mean temperature anomalies were up to 2°C above the long-term average ([www.bom.gov.au/climate/history/temperature](http://www.bom.gov.au/climate/history/temperature)), and the year 2019 was the driest on record for much of the Yellabinna and within the lowest decile for Eyre Peninsula ([www.bom.gov.au/climate/maps/rainfall](http://www.bom.gov.au/climate/maps/rainfall)).

### Threats

Both populations of Yellabinna Grasswren may be threatened by premature senescence of *Triodia*, which has the potential to affect much remaining habitat. *Triodia* senescence appears likely to have caused a major decline in Striated Grasswrens in Ngarkat and Gluepot reserves (L. Pedler pers. obs.). Additionally, exposure to extreme hot weather could lead to mortality of grasswrens. Heat waves, extreme fire weather and droughts are expected to increase in frequency and intensity in the future (Evans *et al.* 2017; Herold *et al.* 2018; Di Virgilio *et al.* 2019; Dowdy *et al.* 2019) and are likely to affect many birds adversely, including grasswrens (Dooley 2019; Conradie *et al.* 2020).

The Yellabinna population occurs in an unfragmented landscape, incorporating extensive dune fields, and has a varied fire history, while the north-eastern Eyre Peninsula landscape is fragmented and contains fewer dune fields. While large and frequent bushfires could render areas of the Yellabinna uninhabitable for a period, this population is likely to be relatively resilient to fire because a relatively continuous habitat enhances its potential for recolonisation. On north-eastern Eyre Peninsula, a bushfire may cause local extinction directly, with little prospect of recovery. Massive fires were responsible for the loss of Mallee Emuwrens in fragmented

landscapes from Ngarkat and Billiatt CPs (Brown 2014). In the 2019/2020 summer, two bushfires on the Secret Rocks Reserve and surrounding properties burnt about 140 km<sup>2</sup> of potential grasswren habitat.

Patch burning practices to produce a heterogeneous landscape of post-fire ages may help conserve the Yellabinna Grasswren by promoting *Triodia* cover of suitable age and structure, and reducing the likelihood of extensive bushfires (Pedler 1991; Penman *et al.* 2011). However, protecting areas currently inhabited by grasswrens from fire must be an initial priority. In the Yellabinna, prescribed burning to protect Sandhill Dunnart habitat from large scale bushfires by producing a mosaic of fire ages is no longer recommended due to the risk of burning currently occupied sites (DEW 2019).

Land clearance, before it was curtailed in South Australia in the late 1980s, eliminated only a small area of habitat known to support Yellabinna Grasswrens (about 735 km<sup>2</sup> within the EOO), but much of the potentially occupied country between the two populations. Most of the known remaining habitat is now within public or private conservation reserves, or under heritage agreement.

Disturbance created by intensive human activity including birdwatching can pose a threat to bird populations of restricted size, particularly if call-playback is used to lure birds. People simply walking towards birds can result in negative behavioural and physiological responses, and frequent visitation can negatively affect breeding success in some birds (Steven *et al.* 2011). The responses of grasswrens and most Australian birds to birdwatching activities have not been studied. Grasswrens are keenly sought by birdwatchers, and this can lead to large numbers visiting a small area, or even targeting the same birds in an accessible and reliable location. Recent revision of the Striated Grasswren complex now makes Eyre Peninsula

one of the most accessible areas for Rufous Grasswrens, being relatively close to Adelaide and eastern States' centres. Hence the depleted Eyre Peninsula population, if it survives, could be at further risk from human interference. Birdwatching pressure in the Yellabinna will be restricted by remoteness and the necessity for off-road transport, but there is public access to Goog's Track where grasswrens occur and, if high numbers of people visit the same site, the presumed small population may be negatively impacted, and there may be effects on other threatened taxa including Sandhill Dunnarts.

### Future research

The Yellabinna Grasswren is poorly known and several questions need to be answered for implementation of effective management and conservation. The north-eastern Eyre Peninsula population has undergone major decline and further field surveys are needed following average or above average rainfall seasons, to assess its evidently precarious status, and to determine whether its recent apparent absence may be due to exceptionally poor seasons with low rainfall and excessive heat. While the Yellabinna population survives, its true distribution remains unknown. For both populations, the specifics of optimal habitat structure and preferred plant species and the relationship between grasswren presence and fire history are unclear. These questions are subjects of ongoing field research.

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for sensitive species (Licence no. 2579), and Simon Verdon and an anonymous reviewer whose critical comments and suggestions improved this manuscript. We acknowledge the traditional owners of the country on which the grasswrens in this study occur, the Yellabinna population being within the Far West Coast Native Title Determination Area, and the north-eastern Eyre Peninsula population in the Bargarla Native Title Determination Area.

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