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Habitats of the Grey Grasswren *Amytornis barbatus diamantina* and a review of the species' distribution

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Grey Grasswrens *Amytornis barbatus* were first described in swamps at the termination of the Bulloo River and that population and nominate subspecies is now considered threatened. A second subspecies is found to the north in wetlands of the Diamantina/Goyder Lagoon/Warburton system. We found the species at 54 sites within the Goyder Lagoon/Warburton floodplain and conclude that that population appears secure. Grey Grasswrens were found chiefly in Lignum (dominant at 57%, present at 88%) and Old-man Saltbush (dominant at 19%, present at 43%) with average vegetation cover of 32.5 per cent but ranging from seven per cent to 81 per cent. While the species occurs above Goyder Lagoon, in both the Georgina/Eyre and Diamantina catchments, connectivity between these localities has not been demonstrated. The Grey Grasswren occurs in a third catchment, Cooper Creek, where its relationship with other populations, including its subspecific status is unproven. The species is best known from dense shrublands of Lignum *Muehlenbeckia florulenta* and Swamp Canegrass *Eragrostis australasica* but we have shown that it occupies and may breed in more open shrublands such as Old-man Saltbush *Atriplex nummularia* ssp. *nummularia*. Our findings question the relative reliance of Grey Grasswrens on these two rather disparate habitats; whether they occupy the more open habitats when forced from deeply inundated Lignum swamps and whether the former serve to aid dispersal between what otherwise appear to be isolated populations.

INTRODUCTION

The Grey Grasswren *Amytornis barbatus* occupies floodplains of inland river systems dominated by Lignum *Muehlenbeckia florulenta* (Higgins *et al.* 2001). The species was first seen in 1921 on the Bulloo floodplain south of the Queensland/New South Wales border but was unidentified at the time (Chenery 1922; MacGillivray 1923; McAllan 2000); it was seen in the same area in 1942 but only described after specimens were taken in 1967 (Favaloro and McEvey 1968; Robinson 1973). A second population was found in South Australia in 1975 during a biological survey conducted by the Nature Conservation Society of South Australia (Cox 1976; Foale 1982). Six pairs were recorded in Lignum and sedge floodplain vegetation in Goyder Lagoon (Diamantina/Warburton system) between Koonchera Waterhole and Pandiburra Bore. This population is now recognised as a separate subspecies *A. b. diamantina,* (Fig. 1) (Schodde and Christidis 1987).

Subsequent records of the Grey Grasswren have extended their known range in South Australia and Queensland. Schodde (1982) reported unconfirmed records from Lake Cudappan and Farrars Creek on the Diamantina River floodplain in Queensland, the latter subsequently corroborated by Jaensch and McFarland (2002) (Fig. 2). In a second tributary system of Goyder Lagoon, Joseph (1982) found Grey Grasswrens between Lake Machattie and Lake Koolivoo on the Georgina River/Eyre Creek floodplains. Ian May saw Grey Grasswrens twice a few months apart in 1982 and again about a year later at Embarka Swamp on the main branch of Cooper Creek west of Innamincka (May 1982 and Ian May, pers. comm.). Later visits to Embarka Swamp by other ornithologists failed to confirm this record (Reid 2000) but Grey Grasswrens were subsequently identified upstream in the Cooper Creek system near Ballera Gas Centre in south-west Queensland (Carpenter 2002). These sightings show that the species is present in a third inland river system, Cooper Creek, but the subspecific status of this population is not known.

Figure 1. *Grey Grasswren* Amytornis barbatus diamantina *hand-held at Goyder Lagoon.* Photo: L. Pedler

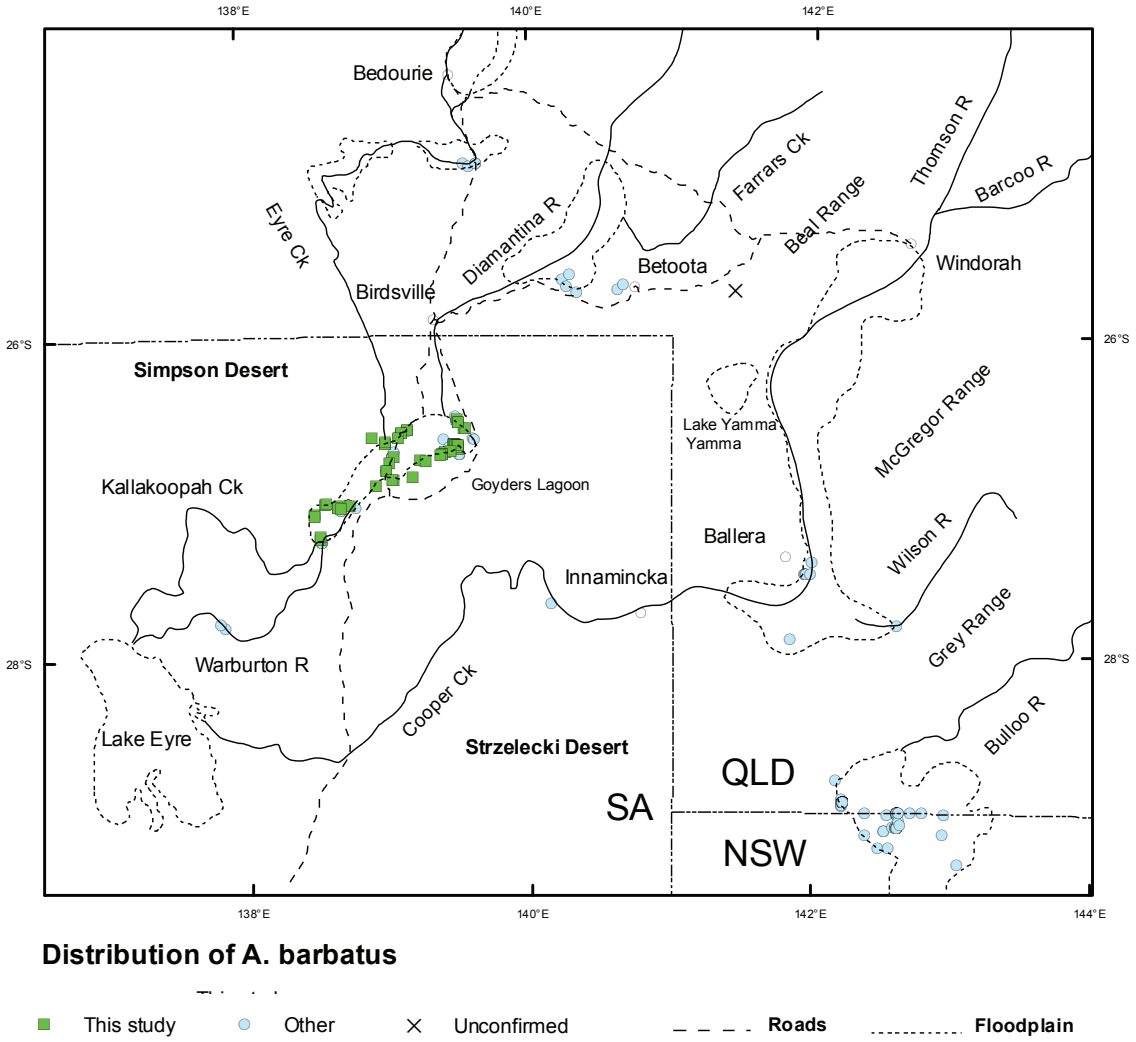

Figure 2. *Records of the Grey Grasswren from this study (■) and other records, accepted (○) and requiring confirmation (×).*

The Grey Grasswren's habitat is generally regarded as Lignum and Swamp Canegrass *Eragrostis australasica* on swamp flats (Schodde and Christidis 1987; Higgins *et al*. 2001), including areas with large expanses of dense Lignum clumps (Hardy 2002), at times with an overstorey of River Cooba *Acacia stenophylla* (Carpenter 2002) as well as the outer fringes of swamp habitat with a sparser, less dense cover (Jaensch and McFarland 2002). These areas also support a range of sedge and rush species, the presence of which is related to flooding (Carpenter 2002). Joseph (1982) found Grey Grasswrens on Eyre Creek at the edge of very dense Lignum in the absence of Swamp Canegrass. More recently *A. b. diamantina* has been recorded in relatively open areas dominated by Old-man Saltbush *Atriplex nummularia* ssp. *nummularia* at the edge of the Goyder Lagoon flood plain (Julian Reid pers. comm., LP, pers. obs.). McAllan and Cooper (1995) also found that *A. b. barbatus* could at times be "seen in areas that were entirely vegetated by old man saltbush some 400 metres from the nearest lignum" and Jaensch and McFarland (2002) described specimens collected in 1984 from chenopod shrublands. Hardy (2010) summarised the habitats of *A. b. barbatus* as tall Lignum (for refuge, feeding and nesting), Swamp Canegrass (for feeding and occasionally nesting in wet periods when Lignum is inundated), Old-man Saltbush (feeding) and samphire (feeding).

Nominate *A. b. barbatus* is listed as vulnerable in Queensland under the Nature Conservation Act 1992 and nationally under the Environment Protection and Biodiversity Conservation Act 1999, and as endangered in the New South Wales Threatened Species Conservation Act 1995. Subspecies *A. b. diamantina* is listed as rare in the South Australian National Parks and Wildlife Act 1972. The species and its floodplain habitat are identified as a Conservation Priority in the SA Arid Lands Draft Biodiversity Strategy (Department for Environment and Heritage 2008). Like most grasswrens the Grey Grasswren is thought to have poor dispersal ability and may therefore be at risk from localised disturbance. Hardy (2002, 2010) considered that impacts on vegetation through intensive grazing by domestic stock and introduced herbivores were a major threat to the Bulloo population *A. b. barbatus* and this might also apply to *A. b. diamantina*.

This study examines the status, distribution and habitats of the Diamantina/Warburton and Cooper Creek populations of the Grey Grasswren in South Australia, identifies potential threats to their conservation and reviews current knowledge of the distribution of the species.

METHODS

We collated previous records of the Grey Grasswren, including specimens in the South Australian Museum, Adelaide (SAMA), Queensland Museum, Brisbane (QM), Australian Museum, Sydney (AM), Museum Victoria, Melbourne (MV) and Australian National Wildlife Collection, CSIRO Canberra (ANWC), Biological Survey SA records, Birds Australia bird atlas data and published and unpublished records of the authors and others.

Two field surveys aimed to re-visit as many sites of previous records in South Australia as were practicably accessible and to search elsewhere in places containing apparently suitable habitat. Four observers searched Embarka Swamp, Cooper Creek, from 24–29 May 2009 and five observers searched Goyder Lagoon and the Warburton River, south to its main anabranch Kallakoopah Creek from 18–27 October 2009. The Embarka Swamp was extensively sampled, particularly its best-watered south-eastern section including the locality of May's earlier sightings. A small flood had peaked at Gidgealpa Homestead, Embarka Waterhole, about a week earlier and had inundated the south-eastern parts of the swamp, particularly an internal terminal swamp which was luxuriant. Water was flowing in many small channels beyond this area and into parts of the swamp visited subsequently in the west and north. The Goyder/Warburton field study followed the occurrence of a moderately large flood of Eyre Creek, the Diamantina and Warburton-Kallakoopah in the summer-to-autumn period of 2008–2009 that had caused over three quarters of Lake Eyre to be covered.

At each locality we walked slowly through the area over a period of 30 minutes, looking and listening for Grasswrens. Most were located first by hearing their high-pitched calls, rather than being seen, but almost all records were confirmed by subsequent direct observation. Calls were given spontaneously or in reaction to the disturbance created by the observers and only rarely in response to high-pitched squeaks, to the playing of the recorded calls of Grey Grasswrens or of other grasswren species. We made habitat measurements at localities where Grey Grasswrens were found and the localities of all sites were recorded with a hand-held GPS unit.

Unless seasonal and viewing conditions were optimal, an anticipated constraint on this study was the difficulty of finding Grasswrens even where there had been previous records, because of the extremely cryptic behaviour of the species (Cox 1976). We did not define unoccupied control sites for comparison with those where Grasswrens were present (as in Black *et al.* 2009a) because we did not presume their absence if they were undetected during a 30 minute search period. .

Habitat measurements

A vegetation transect was undertaken wherever Grasswrens were recorded. Percentage cover was calculated from the ground substrate or plant species present at each two metres point along a 200 metres tape lain over the habitat from where the birds were first located and in the direction that the birds travelled. The heights of plants were recorded in 25 centimetres categories at each point using a range pole. Vegetation types were described at each site based on the estimated cover and species in the highest stratum or storey (after Specht 1972). Any vegetation cover above four metres was recorded as canopy. Canopy species with two per cent or less cover were considered emergent and the vegetation type was defined by the next highest stratum.

RESULTS

The literature and database searches provided 110 records of Grey Grasswrens from 25 separate localities in South Australia as well as records from about 12 localities in Queensland and 12 in New South Wales. All South Australian records apart from that at Embarka Swamp, Cooper Creek, were from floodplains of the Goyder/Warburton/Kallakoopah system. Until recently the most southerly of the latter localities was at the division of the Warburton River and Kallakoopah Creek (Ian May pers. comm., Peter Taylor pers. comm.) but observations from the Warburton on Kalamurina Station about 90 km to the south-west in September 2008 (Chris Coleborn and Judith Hoyle per Richard Jordan, Australian Wildlife Conservancy pers. comm.) provided evidence of an expanded range downstream.

No Grey Grasswrens were seen or heard at Embarka Swamp despite a very thorough examination (see Black *et al*. 2009b for details). The Lignum and associated vegetation were generally healthy in the south and east but appeared dry or dead in places in the north of the swamp, as it was on the evidently long dry flood plains examined upstream towards Innamincka.

Of 24 previous record localities from Goyder Lagoon and the Warburton, four were not re-visited: the two recently recorded on Kalamurina Station for logistic reasons and two Birdsville (outside) Track sites because of uncertainty of their precise localities at the time. In total we identified Grey Grasswrens at 54 sites: 16 of 20 known localities, 15 that were new and 23 close to one or the other (Fig 3). We completed analyses of vegetation transects at 42 sites.

Breeding

We found evidence of breeding at four sites. A nest in Ruby Saltbush *Enchylaena tomentosa* within a Lignum shrub and a nest of fine grasses with two feathered young in a thicket of Lignum sticks protruding through the base of a small Old Man Saltbush were seen at sites 9 and 10 on 21 October. At the latter nest one adult performed a distraction display for several minutes within three metres of an observer, while crawling mouse-like and calling loudly with quivering wings and trailing tail. A short-tailed juvenile was seen with four adults in Lignum at site 12 south of Koonchera Waterhole on the same day. A nest with one pin-feathered nestling and one dried unhatched egg was found at site 25 north of Pandiburra Bore on 22 October.

Habitats

Lignum shrubland was the main habitat of Grey Grasswrens during the study (57% of sites), followed by Old-man Saltbush shrubland (19%) (Table 1). All but two sites were in shrublands.

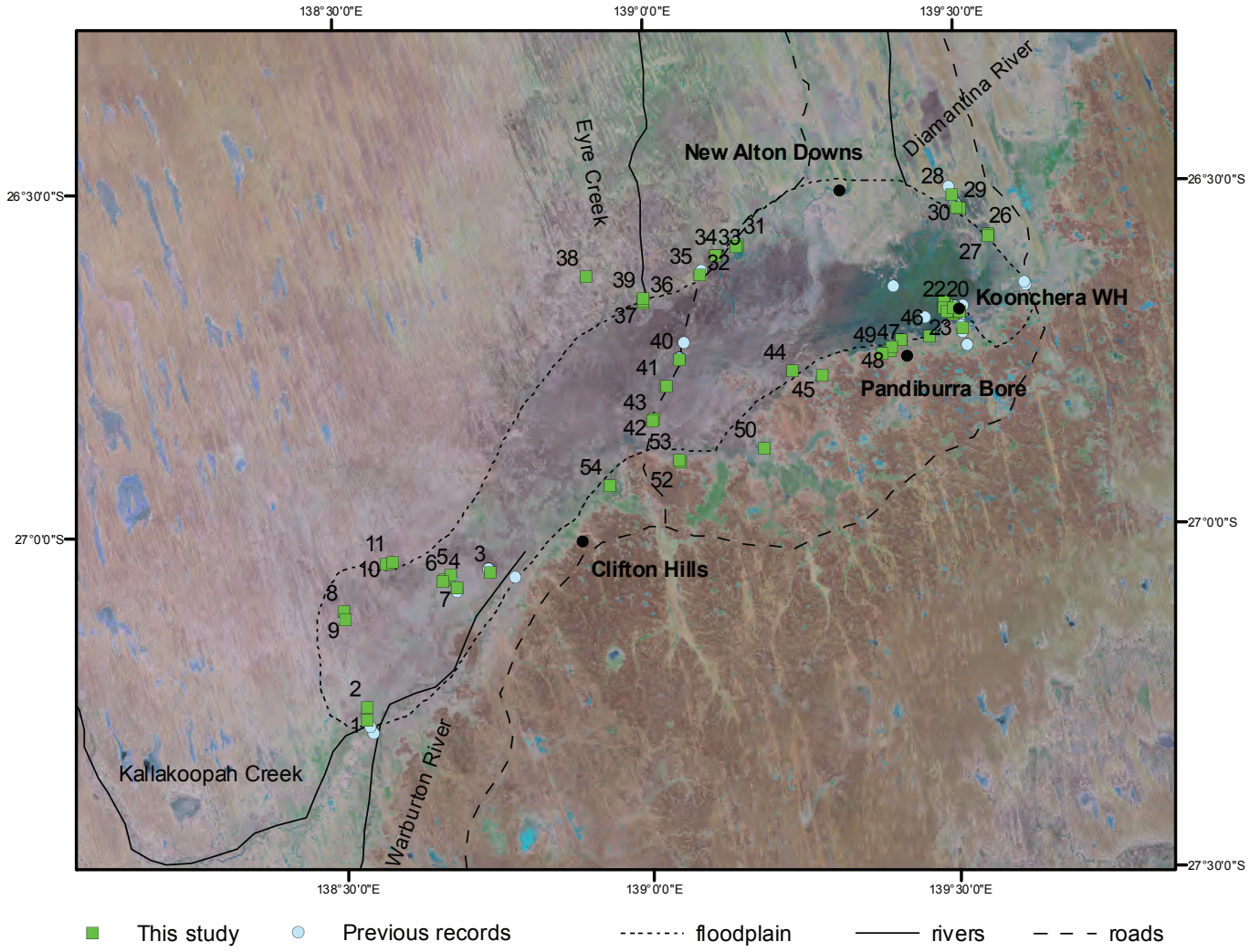

Figure 3. *Area of Goyder Lagoon and upper Warburton River showing previous Grey Grasswren record localities (○) and sites where they were recorded in this survey (numbered ■).*

Sites with Grey Grasswrens averaged 32.5 per cent shrub cover, 34.5 per cent bare ground and 31.5 per cent litter (Table 2). Litter included dead shrubs, sticks and leaves. The cover of shrubs ranged from seven per cent to 81 per cent, the highest in River Cooba low woodland and Lignum shrubland sites and lowest in Old-man Saltbush (7% at site 2) and Queensland Bluebush shrubland sites. Shrub height was mostly between 50 and 150 centimetres. Lignum was present at most sites (88%) and other shrubs present at many sites were Queensland Bluebush *Chenopodium auricomum* (57% of sites) and Old-man Saltbush (43%). Live herbs were found at 48 per cent of sites but contributed little cover.

DISCUSSION

Distribution and status

Our surveys failed to confirm the presence of the Grey Grasswren in the South Australian section of Cooper Creek (Embarka Swamp) but provided evidence of a large population of the subspecies *Amytornis barbatus diamantina* occupying much of Goyder Lagoon and extending downstream in floodplains associated with the Warburton River and its anabranches including Kallakoopah Creek. This population is found in a variety of habitats, from dense tall Lignum shrublands to lower open shrublands of Old-man Saltbush or species-combinations including Old-man Saltbush, Lignum, Queensland Bluebush and Swamp Canegrass. These are associated with the irregularly inundated floodplains of this inland river system. Previous observations from Goyder Lagoon have been in swamp shrublands associated with both the eastern and western terminal branches of the Diamantina River. The majority of eastern records have been in Lignum near Koonchera Waterhole, near Pandiburra Bore to its west, and east of Clifton Hills Outstation to the north. The western records have been from many places along the Birdsville Inside Track near the terminating channels of the Diamantina and initiating channels of the Warburton. In this study we found Grasswrens even further west, near Tepamimi Waterhole where Eyre Creek reaches Goyder Lagoon and at many places near the lagoon's southern margin between Pandiburra Waterhole and north of Clifton Hills Homestead. These findings suggest that the species may be present in suitable habitat across the full

TABLE 1

Vegetation types at Grey Grasswren sites

Vegetation type	No. sites	%	Shrub cover (%, range)
River Cooba low woodland	2	4	62 (43-81)
Lignum shrubland	31	57	39.4 (15-65)
Old-man Saltbush shrubland	10	19	18.7 (7-31)
Lignum & Old man Saltbush shrubland	4	7	26.2 (15-31)
Queensland Bluebush shrubland	1	2	15
Lignum & Queensland Bluebush shrubland	4	7	35.5 (15-60)
Queensland Bluebush & Swamp Canegrass shrubland	2	4	25

TABLE 2

Cover at Grey Grasswren sites.

Cover type	Mean % ± SD	Maximum %	No. sites present (%)
Bare ground	34.5 ± 18.2	77	
Litter	31.5 ± 19.6	82	
Shrub 0-25cm	1		
Shrub 26-50	1.4		
Shrub 51-75	4.4		
Shrub 76-100	7.1		
Shrub 101-125	6.5		
Shrub 126-150	4.8		
Shrub 151-175	2.8		
Shrub 176-200	3		
Shrub >200	1.5		
Total shrub	32.5 ± 16.2		
Lignum		76	37 (88)
Old-man Saltbush		28	18 (43)
River Cooba		11	7 (17)
Queensland Bluebush		14	24 (57)
Live herb		16	20 (48)
Swamp Canegrass		12	3 (7)

A complete list of plant species present at sites occupied by Grey Grasswrens is appended.

extent of irregular inundation of Goyder Lagoon. Downstream a similar inference could be made from both historical and current observations, at least as far as the division of the Warburton and Kallakoopah. Beyond that point there are but two very recent Grey Grasswren records and its status across this less frequently inundated area is therefore uncertain. Upstream of Goyder Lagoon, Grey Grasswrens have been reported from both of its main tributaries, Eyre Creek between lakes Machattie and Koolivoo north of Birdsville (Joseph 1982) and the Diamantina River in channels west of Farrars and Browns Creeks between Durrie and Beetoota (Jaensch and McFarland, 2002). Australian Atlas records (Birds Australia per A. Silcocks) include two subsequent observations from the former locality but none from the latter, both being areas where rivers dissect into extensive floodplains (Fig. 2). The Eyre Creek and Diamantina River populations are about 200 kilometres north and 180 kilometres northeast of Goyder Lagoon respectively; they are of unknown size and appear to be isolated within floodplain areas. While it is possible that birds may disperse along river channels between the floodplains, for example during floods, there has been no report to date to demonstrate such connectivity; these questions require further examination.

Although we were unable to confirm the presence of Grey Grasswrens on the Cooper Creek in South Australia there have been further reports of the channel country Cooper Creek population in south-west Queensland (Carpenter 2002), at the Cooper crossing east of Ballera (A. Silcocks pers. comm.) and to the east near Noccundra on the Wilson River (birding-aus website) (Fig. 2). Further survey work is still required to determine whether the species occupies the extensive areas of Cooper floodplain between Ballera and Windorah, including Lake Yamma Yamma.

McAllan and Cooper (1995) defined the New South Wales distribution of nominate *A. b. barbatus* and Hardy (2010) showed that it had contracted by up to 90 per cent. Curtis (2011)

estimated the subspecies' presently known extent of occurrence as less than 100 square kilometres but observed that, beyond the area surrounding Caryapundy Swamp and the border at Adelaide Gate, some potential habitat in Queensland had not been surveyed (Figure 2).

Habitats

This study has shown that Grey Grasswrens of the Goyder-Warburton population are found not only in densely vegetated Lignum swamps and Lignum-lined channels but in much more open Lignum and other vegetation well beyond the major Lignum swamps. We did not find that Swamp Canegrass was an important habitat component in this population but are unable to infer whether this is a characteristic of the population or merely reflects the dormant status of much of the Swamp Canegrass at the time. Old-man Saltbush shrubland sites were found near the margin of the floodplain where they are unlikely to have been inundated deeply and persistently (Figs 4–7). While Queensland Bluebush was a common component of the vegetation at some sites its characteristically open form suggests that its structural contribution to the habitat requirements of the species may be small.

Further study is required to determine to what extent habitat use across the floodplain changes during floods. Hardy (2002) made observations of Grey Grasswrens in an 11-hectare area of mostly tall dense Lignum in the Queensland section of Caryapundy Swamp on the Bulloo Floodplain during nine years between 1984 and 2000. He found their numbers to be greatest

Figure 4. *Site 7 at recently dry waterhole near Warburton anabranch, Cowarie Station, very tall dense Lignum.*

Figure 5. *Site 12 near Koonchera Waterhole, Clifton Hills Station, sparser and lower lignum, possibly not recently inundated.*

Figure 6. *Site 8 on Warburton floodplain, Cowarie Station, recently inundated Lignum and Old-man Saltbush with emergent Coolibahs.*

Figure 7. *Site 1 on Warburton floodplain, Cowarie Station, open Old-man Saltbush shrubland.*

between 1991 and 1994 (the year of the single breeding record) when conditions were dry and there was no surface water. In 2000, following the first flooding of the swamp for ten years, no Grasswrens were present and he concluded that "dense, tall Lignum serves as a refuge during periods of climatic extremes" and that the Grasswrens had dispersed. In an earlier review of the Grey Grasswren in New South Wales McAllan and Cooper (1995) concluded that their habitats included areas dominated by Lignum, Swamp Canegrass and Old-man Saltbush but they were seen occasionally in adjacent samphire. In a study of the New South Wales population Hardy (2010) reported that Grey Grasswrens of the Bulloorine are dependent on wetlands dominated by dense Lignum, using Swamp Canegrass in wet periods when Lignum is inundated and occupying Old-man Saltbush and samphire for feeding. During our survey we recorded samphire at one Lignum and Queensland Bluebush shrubland site (Site 53), with samphire contributing three per cent cover. McAllan and Cooper (1995) found Grasswrens in Lignum but also in pure Old-man Saltbush areas and concluded that the species might use more than one habitat, depending on the level of water in the swamps. We too consider it likely that during floods Grey Grasswrens move to habitats at the periphery of the floodplain that are neither deeply nor persistently inundated. Such habitats include more open Lignum, Swamp Canegrass (Hardy 2010), Sandhill Canegrass *Zygochloa paradoxa* on nearby dune fringes, as at Koonchera Dune in the 80s (R Kernot pers. comm. to GC) and the Old-man Saltbush and other more open shrublands identified in this study. Such shrublands will demonstrate a growth response to inundation and will be at their densest for some time thereafter. An illustration of this hypothesis was our failure to find Grasswrens near the Warburton Track crossing below Goyder Lagoon or in extensive Lignum along the Warburton between there and the Kallakoopah, yet recording them in more peripheral parts of the floodplain. It was also noteworthy that Grasswrens were unconfirmed or found only at the habitat edge after prolonged searches at three sites east of Clifton Hills Outstation in a very extensive dense and healthy Lignum swamp that retained significant surface water.

Another unconfirmed site on the Inside Track consisted of areas of Lignum of several hectares separated by luxuriant herb-fields, the result of recent flooding. Occupied sites were found to the south nearby and it is again possible that prolonged recent inundation was responsible for the dispersal of Grasswrens, an alternative explanation being that isolated birds had moved or succumbed during dry periods prior to the flood.

One unconfirmed site, south of Koonchera Waterhole, was an area of sparse samphire and low and almost dead Old-man Saltbush that presumably had deteriorated from prolonged drought and/or lack of inundation since Grasswrens were recorded there in October 1992.

McAllan and Cooper (1995) had no record of Grasswrens occupying pure Swamp Canegrass and speculated that it might not be suitable habitat through dry years but that Grasswrens might move into it when healthy and dense following rain or inundation. We observed Grasswrens in Swamp Canegrass at only three sites (50, 51 and 53, Table 2) at the southern edge of the floodplain north-east of Clifton Hills Homestead and most canegrass appeared dead or dormant.

While we have shown that Grey Grasswrens occupy both dense (e.g. Lignum) and more open (e.g. Old-man Saltbush) habitats and while there is evidence to suggest that their occupation of one or the other might relate to the degree of inundation of the former, their nest sites have been reported to date only from Lignum and Swamp Canegrass (Schodde 1982; Higgins *et al.* 2001; Hardy 2002). One nest reported here was in Lignum sticks tangled within an Old-man Saltbush shrub and a nest of the Grey Grasswren was found in an Old-man Saltbush shrub by Julian Reid (pers. comm.) at the eastern edge of Goyder Lagoon on 24 July 2010.

We failed to find Grasswrens at Embarka Swamp on the Cooper despite the presence there of extensive habitat similar to that occupied by Grey Grasswrens at Goyder Lagoon, including dense Lignum with over 50 per cent cover. Reports from that locality covered a period of about a year but there have been no reports from other Lignum swamps nearby, such as those on the well-studied northwest branch (Reid 2000). This suggests that the local Grasswren population in 1982 was a limited one that is now extinct. Between 1973 and 1976 both the Cooper and Diamantina systems were in major flood. If our argument above concerning dispersal of Grey Grasswrens during flood is valid then a major displacement might have resulted at around that time, with subsequent development of small satellite populations distant from their origin, such as in suitable habitat associated with the Cooper. During such exceptional periods of high rainfall and repeated major flooding it is possible that Grey Grasswrens could cross normally inhospitable areas between Goyder Lagoon and the Cooper floodplain and occupy vegetation such as Old-man Saltbush and Swamp Canegrass in gilgais and depressions watered for unusually extended periods. Alternatively but perhaps less plausibly a population in Embarka Swamp might have been founded by movements downstream along the Cooper from floodplains in Queensland through the narrow channel of limited or unsuitable habitat east of Innamincka.

Conservation and Management

Threats to the Grey Grasswren have been identified by Garnett and Crowley (2000) and Hardy (2002, 2010) as habitat degradation from grazing pressures of stock and rabbits and from disturbance by the rooting of feral pigs. While their preoccupation was on the preservation of areas of dense Lignum our findings suggest that such degrading influences might be equally relevant to the more accessible mixed open shrublands of other species such as Old-man Saltbush. Other influences on the quality of Lignum habitat include fire and desiccation. Climate change could lead to increases or decreases in both, while fire can be used as a management tool for opening up areas to encourage grass growth and enhance stock access. We did not find evidence to indicate significant deterioration of habitat for the species on the Goyder/Warburton floodplains. Potentially the most significant threat is a major change in the frequency of inundation with or without more frequent and more extended drought. Such an outcome is possible as a result of climate change or from regulation and excessive exploitation of the upstream water resources of the Georgina/Eyre, Diamantina, Cooper and Bulloo catchments.

Other potential threats may arise from oil and gas exploration and extraction, including spills and disruption of water flows and from the provision of new stock watering points.

Questions unresolved

The occurrence of Grey Grasswrens along the lower Warburton requires further study to establish whether there is a continuous distribution or if there are only small outlying groups that might represent potential founder populations. In addition it remains to be shown if there is continuity between the Goyder Lagoon population and those upstream in Eyre Creek and the Diamantina River, which have not been fully assessed for their distribution and size or for their subspecific status. It is noteworthy that there are no records of Grey Grasswrens from around Birdsville despite substantial observation effort there, suggesting that the population west of Beetoota is isolated from Goyder Lagoon. The size and extent of the Cooper Creek population also remain poorly known and its subspecific status is also unknown. Very extensive areas of potentially suitable habitat in floodplains above Goyder Lagoon and in the Cooper/ Wilson channel country remain to be further investigated. There are also areas in south-west Queensland that remain unsurveyed for the nominate subspecies. The significance of habitats other than Lignum and Swamp Canegrass, such as more open shrublands of Old -man Saltbush requires further investigation to determine if they function merely as a refuge at times of major flooding or whether they have a more pervasive role in the ecology of the Grey Grasswren. Further surveys during differing climatic periods will be necessary in pursuing these questions.

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APPENDIX

Plants present at Grey Grasswren sites. xxx = prominent at many sites; xx = prominent at some sites; x = present in low numbers.

Species	Common name	Abundance
Acacia stenophylla	River Cooba	xx
Alternanthera nodiflora	Common Joyweed	xxx
Atriplex crassipes	saltbush [lacks a common name]	xx
Atriplex nummularia ssp. nummularia	Old-man Saltbush	xx
Atriplex spongiosa	Pop Saltbush	x
Brachyscome ciliaris	Variable Daisy	x
Calotis hispidula	Hairy Burr-daisy	x
Centipeda cunninghamii	Common Sneezeweed	x
Chenopodium auricomum	Queensland Bluebush	xx
Chenopodium cristatum	Crested Goosefoot	x
Cullen australasicum	Tall Scurf-pea (Native Verbine)	xx
Dentella pulvinata	Mud-mat	x
Dissocarpus biflorus	Two-horn Saltbush	xx
Echinochloa inundata	Channel Millet	x
Eleocharis acuta	Common Spike-rush	x
Enchylaena tomentosa	Ruby Saltbush	xx
Eragrostis autralasica	Swamp Cane-grass	xx
Eremophila bignoniiflora	Bignonia Emubush	x
Eryngium supinum	Little Devil	x
Eucalyptus coolabah	Coolibah	x
Frankenia serpyllifolia	Thyme Sea-heath	x
Goodenia glauca	Pale Goodenia	xx
Haloragis aspera	Rough Raspwort	xxx
Halosarcia indica	Brown-head Samphire	x
Lachnagrostis filiformis	Perennial Blown-grass	x
Lechenaultia divaricata	Tangled Lechenaultia	x
Leiocarpa leptolepis	Pale Plover-daisy	x
Malva behriana	Australian Hollyhock	xx
Marsilea drummondii	Common Nardoo	xxx
Muehlenbeckia florulenta	Lignum	xxx
Mukia micrantha	Desert Cucumber	x
Nicotiana velutina	Velvet Tobacco	xx
Panicum decompositum	Native Millet	x
Plantago drummondii	Dark Plantain	xx
Portulaca intraterranea	Buttercup Purslane (Munyaroo)	xx
Pycnosorus melleus	Long-head Buttons	xxx
Pycnosorus eremaeus	Inland Buttons	xx
Rhodanthe floribunda	White Everlasting	xx
Rutidosis helichrysoides	Grey Wrinklewort	x
Salsola kali	Buckbush	x
Santalum lanceolatum	Plumbush	x
Sclerolaena intricata	Tangled Bindyi	x
Senecio lanibracteus	Inland Shrubby Groundsel	xxx
Solanum oligacanthum	Desert Nightshade	xx
Stemodia florulenta	Bluerod	xx
Tetragonia eremaea	Desert Spinach	x
Teucrium racemosum	Grey Germander	xx
Trigonella suavissima	Native clover	x