Comparison of survey methods for detection of the elusive Western Whipbird *Psophodes nigrogularis* with notes on its distribution

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Abstract

Reliable survey methods for detecting the geographic extent of occurrence and population size are needed to inform conservation management of individual species. Commonly used survey methods for monitoring bird populations include transects, point counts, spot maps, area searches, nest searches, and mist netting (mark and recapture). These methods work best on species that are moderately abundant to abundant, and are not particularly effective for rare or elusive species that are usually of the most concern to conservation management. An established approach for monitoring rare and elusive songbird populations is the use of vocalisations, both to assess abundance by identifying individual singers in the field by their songs, using automatic or manual equipment, and to use playback to simulate territory intrusion in order to measure territory defence and presence. The Western Whipbird of southern Australia is elusive and sedentary, and its conservation status varies between the sub-species from Vulnerable to Critically Endangered. Here, we compare two survey methods used to collect distribution data on the Western Whipbird: (1) playback of local Western Whipbird songs; and (2) automated recording stations. The results showed that there was no difference in detectability using the two methods. However, the playback method was less labour intensive than the use of automated recording stations (which required hours of post-collection data analysis). We combined our data with historical data and report that the range of the Western Whipbird has contracted by at least 50% since European settlement 200 years ago.

INTRODUCTION

A large proportion of Australian bird species are declining or threatened due to the effects of habitat clearance and degradation, alien predators, invasive disease, climate change, and inappropriate fire regimes (Garnett and Crowley 2000; Paton and O'Connor 2010). Garnett and Crowley (2000) recognise 25 bird species as Extinct, 32 as Critically Endangered, 41 as Endangered, 82 as Vulnerable, and 81 as Near Threatened in Australia. Reliable survey methods for detecting extent of occurrence and population size are needed to inform conservation management, (Ralph *et al*. 1993; Feria and Peterson 2002; Bibby 2004; Gregory, Gibbons and Donald 2004; Ausden 2007; Parsons, Short and Roberts 2008). Effective surveys monitor prescribed conservation targets and enable detection of long-term population changes over time (Ausden 2007; Parsons, Short and Roberts 2008). Commonly used survey methods for monitoring bird populations include transects, point counts, spot maps, area searches, nest searches, and mist netting (mark and recapture) (Ralph et al. 1993; Bibby 2004; Gregory, Gibbons and Donald 2004; Ausden 2007). These methods work best on species that are moderately abundant to abundant, but are not as effective on rare or elusive species that are usually of the most concern to conservation management (Thompson 2004).

Popular survey approaches need refining to monitor rare and elusive species because they typically have (1) low abundance, (2) limited geographical range, (3) missing life history information (Thompson 2004), (4) are difficult to catch and see, and (5) are sensitive to handling and capture methods (Johnson et al. 1981; Terry, Peake and McGregor 2005). An established approach for monitoring rare and elusive songbird populations is the use of

vocalisations to assess abundance by identifying individual singers in the field (Terry, Peake and McGregor 2005). Presence can be detected using automatic or manual equipment to record singing behaviour, or playback of song to simulate territory intrusion in order to measure territory defence (Marion, O'Meara and Maehr 1981; Johnson et al. 1981; Saunders and Wooller 1988; McGregor, Peake and Gilbert 2000; Gregory, Gibbons and Donald 2004). Both methods have been commonly used to survey visually elusive species that are easily identified by their songs (Marion, O'Meara and Maehr 1981; Terry, Peake and McGregor 2005).

The Western Whipbird (*Psophodes nigrogularis*) of southern Australia is a threatened, ground dwelling, sedentary passerine that is difficult to see. It is widely regarded as an elusive bird and it inhabits dense shrubby habitats (Howe and Ross 1933; Condon 1966; Smith 1991). The bird prefers to run rather than fly, which it does in dense vegetation, making it difficult to observe, rendering visual survey methods problematic. However, Western Whipbirds are sedentary after territory establishment (Smith 1991) and sing a repetitive and distinct territorial song. Whipbird song can therefore be used as the primary means of localisation and confirmation in the field.

The Western Whipbird occurs in six allopatric populations distributed across southern Australia (see Figure 1) (Schodde and Mason 1991). Four subspecies occur in restricted geographic ranges: (1) *Psophodes nigrogularis nigrogularis* in the Two People's Bay – Mt Manypeaks area, Western Australia; (2) *P. n. oberon* in and to the north-east of Stirling Range and Fitzgerald River National Parks, Western Australia; (3) *P. n. lashmari* on Kangaroo Island, South Australia; and (4) *P. n. leucogaster* in the Murray Mallee, Eyre and Yorke Peninsulas, South Australia (and formerly in Victoria) (Christidis and Boles 2008).

The global conservation status of Western Whipbirds is currently 'Near Threatened' (BirdLife International 2008). Its conservation status in Australia varies among subspecies and regions. The federal environment legislation in Australia, the Environment Protection and Biodiversity Conservation (EPBC) Act 1999, recognises (1) *P. n. leucogaster* as Vulnerable; (2) *P. n. lashmari* as Vulnerable because it is not currently listed separately under the Act but is included with *P. n. leucogaster*; (3) *P.n. nigrogularis* as Endangered; and (4) *P. n. oberon* was previously listed as Vulnerable but in a 2009 review it was considered not eligible for listing under any of the EPBC Act criteria (DEWHA 2009abc; Threatened Species Scientific Committee 2009). Under the Victorian state legislation, the Fauna and Flora Guarantee Act 1988, *P. n. leucogaster* is listed as Critically Endangered, though it is now considered to be extinct in Victoria, with no confirmed records since 1974 (Hunt 1976; Woinarski, Eckert and Menkhorst 1988; Baker-Gabb 2005). South Australian state legislation, the National Parks and Wildlife Act 1972, lists *P. n. leucogaster* as Endangered and *P. n. lashmari* as Rare. State legislation in Western Australia, the Wildlife Conservation Act 1950, currently lists *P. n. nigrogularis* as Endangered and *P. n. oberon* is not listed under the act but it is acknowledged that it is a taxa in need of monitoring (DEC 2010). In contrast to the legislative status, Garnett and Crowley (2000), in the Action Plan for Australian Birds, used IUCN criteria to recommend that (1) *P. n. leucogaster* be upgraded from Vulnerable to Endangered, (2) *P. n. lashmari* be listed as Near Threatened, (3) *P. n. nigrogularis* be listed as Vulnerable, and (4) *P. n. oberon* be listed as Near Threatened.

In this study, we compare the effectiveness of field-based song recording devices (hereafter automated recording stations), and the experimental playback method to detect Western Whipbird presence across two of the four populations of the species' range in South Australia. We also present an historical and present day account of its distribution over the last 168 years since Europeans first recorded the Western Whipbird.

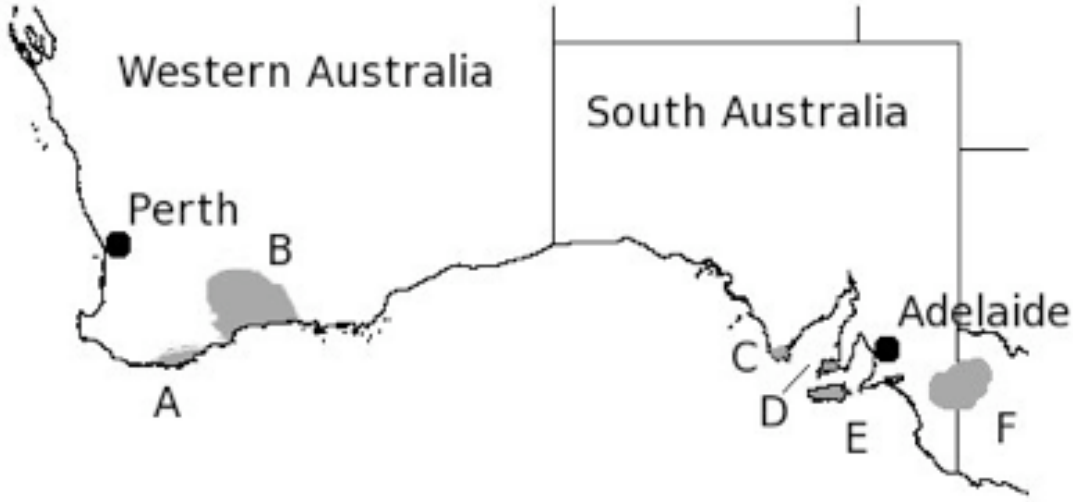

Figure 1. Sub-species locations of the Western Whipbird *Psophodes nigrogularis*. **(A)** *P. n. nigrogularis* **– Two People's Bay- Mt Manypeaks Region; (B)** *P. n. oberon* **– Stirling Ranges- Fitzgerald River National Park region; (C, D, F)** *P. n. leucogaster* **– Eyre Peninsula, Yorke Peninsula and Murray Mallee regions respectively; (E)** *P. n. lashmari* **– Kangaroo Island.**

METHODS

Study Species

Western Whipbirds have a generation time of five years (Garnett and Crowley 2000) and are territorial, occupying home ranges of 0.126 ± 0.027 km^2 with a core territorial range of 0.018 ± 0.003 km^2 (Smith 1991). Birds maintain the same home ranges from year to year, and are monogamous across years (Smith 1991). Males defend their territory with singing bouts that have a duration of 3-15 minutes (Webster 1966; McGuire personal observation). This is a duetting species in which both the male and female sing; each of which has a distinctive song. Western Whipbirds sing throughout the year, gradually increasing their song output from April to July, reaching a peak between July and September, and from September to December there is a gradual decline in singing intensity (Smith 1991). During the breeding season, pairs often sing together to form an antiphonal duet. Females sing a shorter and less variable song than the males. Females sing considerably less in August, coinciding with the nesting period for this species (Smith 1991). Singing occurs during the first four hours after sunrise, but is most frequent during the two hours after sunrise and one hour before sunset (Smith 1991). Songs can be heard up to 800 m from their origin in good weather conditions (Condon 1966; McNee 1986; McGuire personal observation).

Study Sites

Surveys were conducted at two South Australian locations: (1) southern Eyre Peninsula (-34° 52′ 135° 56′), and (2) southern Yorke Peninsula (-35° 13′ 136° 53′). Historical data were retrieved from the South Australian Government Department of Environment and Heritage biological database (date of retrieval: 29th July 2009), and Western Australian Government, Department of Environment and Conservation biological database (date of retrieval: 24th November 2009 by Allan

Burbidge) for the above locations and for (3) Kangaroo Island, South Australia (-35° 51′ 136° 52′), (4) Two People's Bay – Mt Manypeaks area, Western Australia (-34° 98′ 118° 18′), and (5) in and to the north-east of Stirling Range and Fitzgerald River National Parks (-34° 04′ 119° 25′).

Survey Methods

To detect Western Whipbird abundance on Yorke Peninsula and Eyre Peninsula in South Australia we used two survey methods: (1) automated recording stations (2007), and (2) playback experiments (2008) were repeated at the same automated survey points to elicit a response from Western Whipbirds present in the area. The playback experiments were done one year after the automated recording stations had collected the data, but before the data were analysed. That is, the playback trials were done without prior knowledge of whipbird presence or absence.

Automated recording stations were designed and manufactured by Faunatech Wildlife Consultants, Bairnsdale, Victoria. The recording devices consist of a cassette recorder housed within a weatherproof ammunition box and a microphone attached to a metal pole, 2 m above ground level, with a weatherproof 'hat' over the microphone to prevent damage and noise made by rain and wind. The sensitivity of the microphone was 320 uv and 200-600 Ω. The recording system contained a timer that enabled the device to be turned on and off at pre-set time periods. The recording stations were initially programmed to record for 25 minutes after sunrise and 20 minutes before sunset. However, after a pilot study conducted over two weeks, we restricted recordings to sunrise (excluding the sunset period all together) and extended the recording time to 45 minutes from sunrise (restricted by the recording length of the analogue tapes we used). These changes were necessary following our observation that Whipbirds can have song intermissions of up to 60 minutes between 'bouts' of calling and that some Whipbirds do not sing in the evening but are more likely to sing in the morning (Webster 1966). We placed 120 automated recording stations 1 km apart in potential Western Whipbird habitat on the Eyre (n=29) and Yorke (n = 91) Peninsulas between the months of May and October in 2007.

We conducted 120 experimental playbacks in 2008 at the same coordinates used for the automated recording stations. The playback was conducted only during fine weather between 7.00 am (sunrise) and 11:00 am between the months of May and October in 2008. We played local Western Whipbird song continuously for three minutes and recorded the response of the bird for three minutes following the playback stimulus. We used a compass to record the respondent's angle from the coordinates, and estimated the distance of the respondent to the playback. To record vocalisations, a Korg MR-1000 recorder (Korg Inc., Japan) and a Telinga Twin Science parabolic microphone (Telinga Microphones, Sweden) or a Sennheiser MKE 80R shotgun microphone (Sennheiser, Germany) were used.

Government Databases

Historical distribution data were collated from six populations in Western Australia and South Australia. Records dated from 1842 to 2005 and were collected by: (1) transect surveys; (2) opportunistic observations reported by Government officials and the general public; and (3) mist-netting and specimen collection by the South Australian and Western Australian Museums (Biological Database of South Australia – Date of retrieval: 29th July 2009; Department of Environment and Conservation Database - Date of retrieval: 24th November 2009 by Allan Burbidge).

RESULTS

Comparison of survey methods

Using automated recording stations in 2007, we detected Western Whipbirds at 5 of the 29 (17.2%) survey sites on Eyre Peninsula, and 6 of

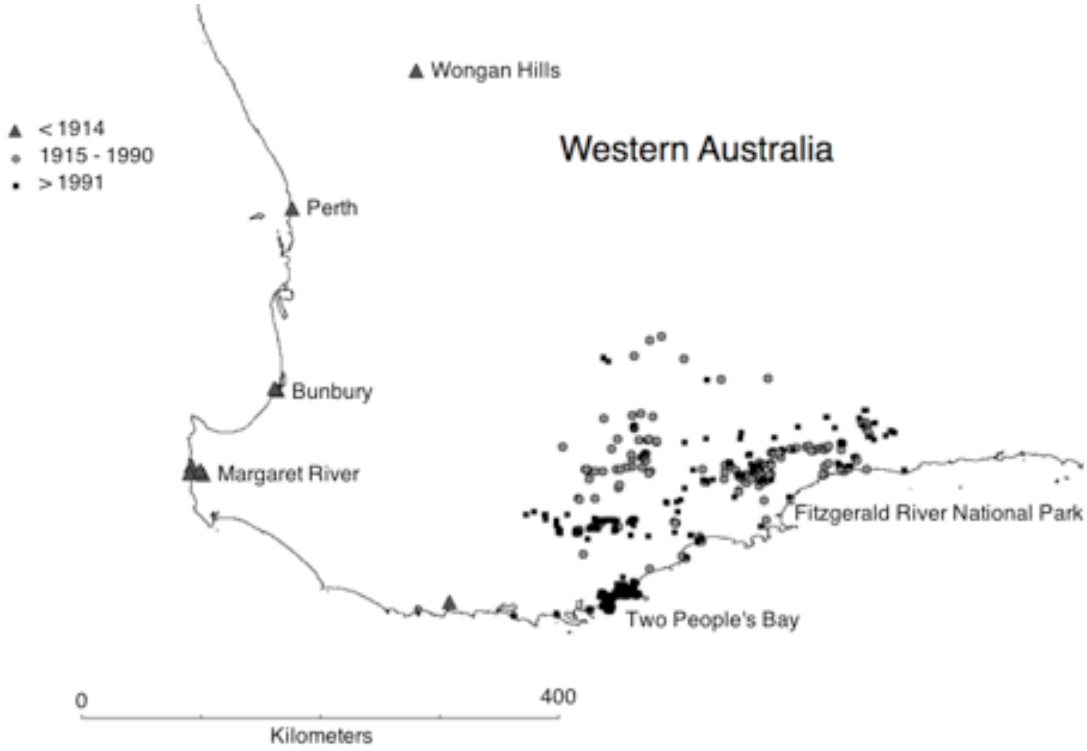

Figure 2. The range of the Western Australian subspecies *Psophodes nigrogularis nigrogrularis* **(Two People's Bay area) and** *P. n. oberon* **(Fitzgerlad River National Park area) has contracted since the arrival of Europeans. Triangles indicate where Whipbirds occured prior to 1915; circles indicate presence between 1915 and 1990 and squares indicate occurred from 1991 to 2009.**

the 91 sites on Yorke Peninsula (6.6%). Using playback in 2008, we detected birds at 7 of the 29 (24.1%) sites on Eyre Peninsula and 5 of the 91 (5.5%) sites on Yorke Peninsula. There was no significant difference in detectability in either location using the different survey methods (χ^2 = 0.42, P = 0.517 for Eyre Peninsula; χ^2 = 0.11, P = 0.741 for Yorke Peninsula).

DISCUSSION

The experimental playback method was no more effective than automated recording stations at detecting the presence of Western Whipbirds. Therefore, we concluded that either method could be used to detect the presence of Western Whipbirds. Playback experiments have the advantage that Western Whipbird presence can be detected within minutes if the bird responds to the playback stimulus, and require no set-up or removal of the recording stations. Also, any equipment failure would be detected at the time of the playback. However, this method's efficiency differs according to the ability of the surveying personnel (Rempel et al. 2005; Brandes 2008). Automated recording stations are more labour intensive than playback experiments, because of the time required to set-up the stations and to analyse the recordings. The survey time per day is limited by the length of the cassette tape (typically 45 minutes for each side). Western Whipbirds have long periods of singing inactivity, with song intermissions of up to 60 minutes. These long intermissions necessitate long periods of concentration by people analysing recordings if they are listening by ear. However, the time required to detect a focal song can be reduced if the tapes are digitised and then analysed using

spectrograms produced by bioacoustics software (Brandes 2008). Automated recording stations need to be placed at frequent intervals because of the large territory size of the birds (core range of 0.018 ± 0.003 km^2), which is unknown to the observer setting up the recording stations. Automated recording stations have the advantage that they can be set up by community groups and subsequently scored by someone with the skills to recognise Western Whipbird songs (Rempel et al. 2005). Another benefit is that there remains a permanent record of the survey that can be archived on the cassettes for later use (Rempel et al. 2005). Digital recordings (not used in this study) are preferable to analogue recordings at automated recording stations (see Acevedo and Villanueva-Rivera 2006; Brandes 2008) because they have greater signal-to-noise ratio, require less physical storage space, can be backed-up with ease, and offer easy opportunity for electronic information transfer and analysis, using increasingly sophisticated bioacoustics software (Rempel et al. 2005; Brandes 2008).

Historical trends and estimated population size

The once widespread distribution of Western Whipbirds in Australia has contracted since European arrival 200 years ago, due primarily to habitat loss resulting from agriculture and altered fire regimes (Smith 1977; Smith 1985; Smith 1991; Garnett and Crowley 2000). The population dynamics of Western Whipbirds remains unknown. On a number of occasions, populations have been reported as extinct, only to be rediscovered again years later. They were first discovered by John Gilbert in Western Australia in 1842 at Wongan Hills. Relatively widespread at that time, they occurred in areas as far as Perth, Bunbury, and Margaret River; areas that have since been abandoned by Western Whipbirds (known locations of Western Whipbirds in these areas prior to 1915 are indicated by triangles in Figure 2) (Howe and Ross 1933; Whittell 1951). In 1926 they were declared as 'probably extinct' in Western Australia because they had been seen so rarely (Royal Australasian Ornithologists Union 1926), until in 1939 they were rediscovered (Whittell 1939). However, they were not sighted again until 1962, when a population was found in Two Peoples Bay, Western Australia (Webster 1966).

Similar events unfolded in South Australia and Victoria. Europeans officially discovered the sub-species *P. n. leucogaster* in Manya, Victoria (the Murray Mallee) near the South Australian border in 1932 (Howe and Ross 1933; see Joseph 1991 for a comprehensive review). Ten years later, the sub-species was reported as extinct in this region, but was rediscovered in the late 1960s (Hunt and Kenyon 1970; Joseph 1991). More recently, this population was still found to extend into Billiat Conservation Park, Ngarkat Conservation Park and the Malinong area. In their review, Cale and Mladovan (2008) report an extant but small and widely dispersed population in Billiatt Conservation Park in 2003 and 2004. However, subsequent surveys conducted in 2006 and 2007 did not find any Western Whipbirds (Gates 2003; Clarke 2004; Gates 2005). They report a similar story in Ngarkat Conservation Park where in 2005 only three individuals were detected. Again, no individuals were detected in similar surveys conducted in 2006 and 2007. The latest record for Ngarkat has been an opportunistic sighting by departmental staff in the area in 2008 (J. Gitsham pers. comm.). Today, few individuals are thought to remain in the region, likely due to the effects of a large wildfire that came through Ngarkat Conservation Park in 2006 (Dennis 2008; Cale and Mladovan 2008; B. Kaethner pers. comm. 2009), and the birds are likely to be extinct in Victoria (Cale 2007).

The elusive nature of the whipbird meant that remaining South Australian populations were not discovered until the late 1960s. The Yorke Peninsula population was discovered in 1965 (Condon 1966), the Eyre Peninsula population was suspected in the 1920s (Collins in Howe and Ross 1933), but was not widely known until McNamara published the discovery in 1966, and the Kangaroo Island population was first recorded by H. Crouch in 1967 (Condon 1967;

Lashmar 1971). The Eyre Peninsula population has since contracted in range, although the approximate time period in which this occurred is unknown. Hugh Collins reported a sighting as far north as Cowell and Kimba, approximately 200 kms from today's extant populations near Port Lincoln, and well before the discovery of a population in this region in 1966 (Collins in Howe and Ross 1933; McNamara 1966). However, they are no longer found in the location where Collins first reported them.

The population at Two Peoples Bay-MT Manypeaks region in Western Australia, *P. n. nigrogularis*, is estimated at <100 pairs ('A' in Figure 1) (Smith 1991). *P. n. oberon*, the northern Western Australian population, is estimated to consist of 5000 individuals ('B' in Figure 1) (Garnett and Crowley 2000). The South Australian population was estimated to have 2000 individuals: 250 on each of the Eyre and Yorke Peninsulas, and 1500 in the Murray Mallee ('C', 'D', and 'F' respectively in Figure 1) (Garnett and Crowley 2000). However, surveys conducted by Gates (2003), Clarke (2004), and Dennis (2007) detected fewer than five individual Western Whipbirds in the Murray Mallee region and suggest that several formerly occupied sites are now abandoned. Once considered the stronghold of *P. n. leucogaster*, there is a need to invest substantial effort to conserve remaining mallee habitat and control wildfires and prescribed burning in this region. Without this population, the approximated 2000 *P. n. leucogaster* individuals thought to be extant would drop to only 500: 250 in the Yorke region and 250 in the Eyre region for this sub-species. The population size on Kangaroo Island (*P. n. lashmari*) remains unknown but it is thought to be relatively secure, compared to those on the mainland, despite recent destructive wildfires in the region (Pisanu and Baxter 2009).

Distribution

Using estimates of area of occupancy in Garnett and Crowley (2000) calculations of the area over which Western Whipbirds were distributed suggest that they previously occupied approximately 4,400 km2 (across southern Australia) but that figure has likely contracted by a minimum of approximately 2,300 km^2 (52%) since European settlement. This is probably due to clearance of mallee for agricultural purposes, destruction of habitat caused by wildfires (Garnett and Crowley 2000) and frequent controlled burning. Historical records show that in 1842 and 1898, Western Whipbirds were detected as far as Wongan Hills (near Perth) (-30° 89' 116° 71') and in Bunbury (-33° 34' 115° 64'), Western Australia, some 475 kms and 297 kms respectively, from Two People's Bay – Mt Manypeaks area (-34° 98' 118° 18'), where they are extant today (see Figure 2). The Murray Mallee population of *P. n. leucogaster* located on the South Australian and Victorian border has also contracted in range. There are no confirmed records of Western Whipbirds in Victoria since 1979 and only unconfirmed records up to 1984 (Hunt 1976; Woinarski, Eckert and Menkhorst 1988; Baker-Gabb 2005), and the Victorian population is considered to be extinct by departmental staff working in the area (Baker-Gabb 2005). Departmental staff are concerned about the stability of Whipbird numbers on the Yorke Peninsula because they are hearing them less frequently in protected areas (C. Paterson pers. comm.).

CONCLUSION

Both playback and automated recording stations yielded the same detectability of Western Whipbird presence. The range of the elusive Western Whipbird has contracted over the past century. *P. n. leucogaster* is thought to be extinct in Victoria and the South Australian Murray Mallee but historical trends have shown that Western Whipbirds can recolonise areas from which they were thought to have disappeared. Current population numbers are low but presumably stable in national parks with suitable habitat. The biggest threat to Western Whipbirds is habitat clearance and, we

suspect, frequent prescribed burning if suitable refuge areas are not available. Further research is needed on the reproductive biology, population dynamics and age-of-burn preferences in Western Whipbirds. Continued monitoring of extant populations is strongly recommended, particularly in areas where they are thought to be extinct. We recommend a reconsideration of the conservation status of the Western Whipbird at both state and federal levels, particularly in light of the probable extinction of *P. n. leucogaster* in the Murray Mallee region, where only sporadic sightings have been detected despite extensive surveying in the area (Gates 2003; Clarke 2004; Gates 2005; Dennis 2007; Cale 2007; Cale and Mladovan 2008).

ACKNOWLEDGEMENTS

This project was funded by a Threatened Species Network Community Grant awarded to Greg Johnston. We thank the research volunteers Margaret and Gordon White, the Friends of Innes National Park on Yorke Peninsula; Colin Gill, Bernie Casanova and Jenny Chillingsworth, and others, in the Southern Eyre Birds group and the Friends of Lincoln National Park on Eyre Peninsula; Jennifer Hayes and ZooWatch, for their support. These folks were instrumental to conduct the surveys and provided invaluable local knowledge. We also thank Peter Wilkins and Sarah Way (SADEH Eyre Peninsula, SA), Caroline Paterson & John Gitsham (SADEH Yorke Peninsula, SA), Allan Burbidge, and Sarah Comer and Mark True (WADEC Albany, WA) for their invaluable assistance throughout this study.

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