Results from a Bird Monitoring Project in the Cowra Region of NSW

April 2009

This report was produced by
Cowra Woodland Birds Program Committee
and it summarises Reid & Cunningham (2008)
Statistical Analysis of the First Six Years of Bird Surveys for the Cowra Woodland Birds Program: Trends and Implications for Woodland Bird Conservation in the Cowra Shire, NSW.

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Introduction and aims

The Cowra Woodland Birds Program (CWBP) commenced in 2001 in response to local landholders' concerns about noticeable declines in local woodland birds and as such, the group has initiated and implemented a series of projects aimed at reversing the decline of woodland birds in the region. The projects have focused on two issues: firstly, scientific research to improve knowledge of woodland bird habitat requirements and secondly, on-ground habitat restoration projects to improve bird habitat. They have relied on the direct participation of the local landholders and land managers, and involved the Cowra Shire Council, Lachlan Catchment Management Authority as well as members of Birds Australia Southern NSW & ACT.

One of this group's major initiatives has been to establish and maintain a regular bird survey monitoring project across a range of mainly wooded habitats in the Cowra region. Surveys using volunteer bird enthusiasts commenced in autumn 2002 and have continued on a quarterly basis to capture changes in the presence and abundance of birds in all seasons. In 2007 the Lachlan Catchment Management Authority approached the Cowra Woodland Bird Committee about analysing their data to provide information on local bird population trends that could be used as part of their biodiversity monitoring program. A key responsibility of the Lachlan CMA is the monitoring and evaluation of biodiversity enhancement activities. An agreement was reached and the Lachlan CMA commissioned Birds Australia to conduct a statistical analysis and review of the CWBP bird survey database with the broad goals of:

- undertaking a trends analysis of individual bird species and composite bird indices.
- evaluating the strength of the database and survey methodology to detect trends,
- assisting the CMA with its monitoring and evaluation obligations, and
- identifying areas and habitat of high conservation value for woodland birds in the Cowra Local Government Area.

This is a short summary of the report provided to the Lachlan Catchment Management Authority, with the reference to the full report being:

Julian R.W. Reid and Ross B. Cunningham, 2008. ***Statistical Analysis of the First Six Years of Bird Surveys for the Cowra Woodland Birds Program: Trends and Implications for Woodland Bird Conservation in the Cowra Shire, NSW.*** Unpublished Report to Lachlan Catchment Management Authority, Birds Australia and The Fenner School of Environment and Society, ANU, Canberra.

The aims of this brief report are to disseminate the results of their analysis more widely, and make the findings easily accessible to a broad readership. If readers would like more detailed information they should contact either Birds Australia or Lachlan Catchment Management Authority for a copy of the more comprehensive report.

Methods

Site Selection

Original site selection was based on dominant vegetation type and patch size of remnant vegetation (Wilson 2003), with a preponderance of sites being located on farms in the lower slopes and plains in the Cowra Shire. Furthermore, the survey sites were located to sample a range of vegetation types, patch sizes, habitat condition and age structure.

Site selection changed over the course of the study and 97 sites have been surveyed at least once. In the last few years new sites have been added to examine the responses of birds to vegetation enhancement activities and typically these new sites are degraded woodland patches or paddocks without tree cover at all. Overall, across the survey period there has been a trend towards sampling a greater portion of sites with favourable habitat for woodland birds. The spread of sites across the Cowra Shire Council area is detailed in Figure 1. The study reported here is based on survey observations from autumn 2002 to autumn 2008.

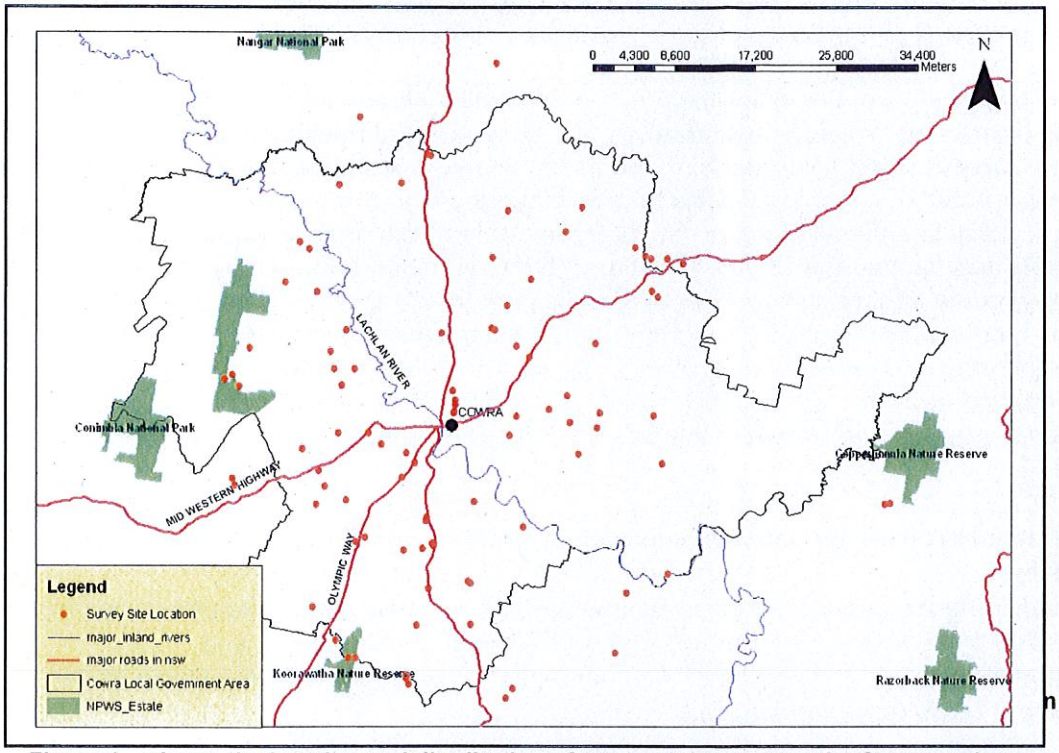


Figure 1 – shows the location and distribution of surveys sites across the Cowra region

Bird survey methodology

Survey methodology was based on the standard Australian Bird Atlas 2 hectare, 20 minute survey method of Barrett *et. al.* (2008) refined by recording the abundance of each species seen within the search area and time period. The data were collected by 50 volunteers from Birds Australia and local bird enthusiasts from the Cowra region. The 2 hectare survey method entails the recording of species seen and count data for each species, during a 20 minute search. Additional individuals and species adjacent to and flying over the 2 hectare site are recorded separately (incidental records). Bird detection and identification skills varied significantly amongst observers, but the survey organisers strived to place competent field ornithologists in each survey party (usually one to three people). Observers were urged to complete

their surveys by 11 am or earlier on days of extreme heat or rising wind. Observer parties were assigned three to five sites a day and surveys were generally conducted by all parties on a designated weekend in each calendar season.

Cowra Woodland Bird Program Database

All survey forms are sent to the Cowra Woodland Bird Program Database Manager, who enters the data into an Access Database. Perfunctory error checking is undertaken and, for instance, any observations of unusual bird species that cannot be verified are removed from the database.

For the purposes of this study all species recorded in the database were classified as waterbird or landbird and all landbirds were classified as woodland-dependent or not following the classification of Reid (2000). A list of threatened and declining bird species for the Cowra region was compiled, based on threatened species listings (National and NSW) and the list of declining woodland species in Reid (1999) for the NSW Sheep-Wheat Belt. More species have been added since by including species from the Threatened Species List for the ACT and from the list of 'At Risk' species in Traill and Duncan (2000) for NSW temperate woodlands.

Environmental and climatic data

Biophysical data were gathered at 69 sites by Wilson (2003) in early 2002 and the main features recorded were: vegetation in the upper storey (trees); tall mid storey (shrubs 2-4 m high); low shrub storey (0-2 m high); ground storey vegetation (forbs, grasses, herbs and weeds); litter; logs; rocks; bare ground; and the presence and cover of cypress pine *Callitris* species. Landuse, tenure, the patch size of remnant vegetation in which the site was located, and connectivity (distance) to nearest, larger vegetation remnants were also recorded. In addition, weeds and feral animal presence and abundance were noted. However, comparable surveys have not been undertaken at the 28 sites that have been added since the first year of surveys.

Monthly rainfall data for Cowra spanning the period January 2000 to April 2008 were obtained from the weather station at the Department of Environment and Climate Change Research Centre at Cowra.

Statistical analysis and trend detection.

A Generalised Linear Mixed Model (GLMM) framework was employed in Genstat to enable the modelling of two types of response variables, namely single species and composite indices. Single species were modelled in two ways. The first approach analysed **reporting rate** of species across sites and surveys by converting all count data to presence/absence. Reporting rate is defined as the number of surveys in which the species was recorded divided by the totals number of sites surveyed that weekend, and this allowed all sites to be used within the logistic modelling framework. Secondly, the **conditional abundance** of species was modelled in a 'quasi-Poisson' framework, but this class of models could only use a subset of sites, conditional on the species having been recorded at the sites used. The main composite variables were species richness and total bird abundance, computed for all land bird species, woodland dependent species and non woodland species. A third composite index of 'bird habitat quality' was trialled. All variables were modelled and plotted to depict trends through time and to examine correlations with rainfall data. The use of regression splines allowed the analysis to focus on long term trends in the data by smoothing over the seasonal and short term fluctuations (see Cunningham and Olsen 2009). Only sites with at least 4 observations/visits (N=86) were included in the modelled data.

Bird habitat score
A site-based habitat quality measure was constructed using the records of bird species detected at sites across all surveys. Woodland-dependent bird species were assigned a value of 1, declining species a value of 2, and threatened species a value of 3. Using only the data relating to birds recorded within the 20 minute, 2 hectare surveys, therefore excluding off-site incidental observations, these 'bird habitat scores' were summed at each site for every survey. The mean scores at a site then allow us to examine those sites with the highest habitat value for woodland birds.

Results and Discussion

Woodland and non-woodland bird species population trends
A total of 1482 surveys across 24 weekends have been conducted from autumn 2002 to autumn 2008 and a total of 202 bird species have been recorded during this period. Of these 146 land birds have been recorded on or near the 97 survey sites with 88 species being classified as woodland dependent and 58 as non-woodland species. Birds that were recorded during the 20 minute 2 hectare surveys numbered 137 of which 83 were woodland dependent species (hereafter referred to as woodland birds) and 54 as non-woodland species.

Data for six years of bird surveys in the Cowra region revealed significant declines in bird species richness and abundance, both for woodland and non- woodland birds (see Figure 2). Non-woodland birds showed dramatic changes in reporting rate over the survey period; their species richness and abundance declined in the first two years (of lower rainfall), recovered in the middle of the period (when rainfall increased) and then declined again to lower values towards the end of the survey period, before recovering again during the last three surveys. Rainfall fluctuations across the survey period correlate strongly and positively with trends in non-woodland bird species, and so we cautiously conclude that this group of species tracks those food resources that are generated by significant rainfall events, and that these resources are probably associated with agricultural production (and weeds) across the entire landscape.

Woodland bird species richness and abundance suffered steady declines over the same period with mean woodland bird species richness dropping from approximately 3.5 species per site visit at the commencement of surveys to 2.5 species, while woodland bird community abundance has deceased from 13 to7 birds per survey and with no signs of recovery at the end in either measure. The pervasive decline of woodland bird species is serious cause for concern. Figure 2 shows clearly the differences in trends through time of woodland vs non-woodland bird indices, and we interpret the results for woodland birds as indicating that habitat condition in the woodland remnants continues to degrade, given our assumption that woodland birds are heavily reliant on resources within native vegetation remnants.

Threatened and declining bird species population trends
Of the 13 threatened species seen in the Cowra Shire during the CWBP surveys over the last 6 years, only 4 species were recorded at high enough frequency to enable modelling of trend data. Table 1 lists the results and Appendix 1 details the graphical trends for these threatened species.

Table 1 – Threatened species that were detected at high enough frequency during surveys to meet the threshold for analysis of trends over time.

Threatened species	Trend detected during 6 year period of surveys
Superb Parrot	Declined
Brown Treecreeper	Declined
Diamond Firetail	Declined
Grey-crowned Babbler	Stable

The reporting rates indicate a significant negative trend through time in the Superb Parrot, and its mean abundance on sites more than halved during the survey period. However, the month of survey was altered halfway through the survey period to a time when the Superb Parrot is nesting in earnest and becomes less noisy and obvious. Accordingly, there are some reservations about whether the species declined to the degree indicated. The Brown Treecreeper declined in abundance by almost half, the Diamond Firetail showed a significant negative linear trend in reporting rate, while no obvious trends were apparent for the Grey-crowned Babbler.

Figure 2 – Grey-crowned Babbler (photograph - L. Villy)

Of the 21 species considered to be declining in the Cowra area only nine exceeded the observation frequency that was required to meet the threshold for analysis. Table 2 lists these species, with reporting rate and conditional abundance graphical trends for several declining species depicted in Appendices 1 and 2 respectively.

Table 2 – Declining species that were detected at high enough frequency during surveys to meet the threshold for analysis of trends over time.

Declining species	Trend detected during 6 year period of surveys
Dusky Woodswallow	Declined
Eastern Yellow Robin	Declined
White-browed Woodswallow	Declined
Crested Shrike-tit	Declined
Restless Flycatcher	Declined
White-browed Babbler	Stable
Jacky Winter	Stable
Rufous Whistler	Stable
Buff-rumped Thornbill	Increased

Of the 13 threatened and declining species that could be modelled, the majority (8) showed downward trends over the six years, four showed a stable trend and one (Buff-rumped Thornbill) showed an increase in abundance and reporting rate during the survey period. The remaining threatened and declining species were detected too infrequently to be modelled and so greater survey effort (more sites with these

species in occupation) and a longer survey period are required to accumulate sufficient observations for future modelling and analysis.

Figure 3 – Eastern Yellow Robin (photo from http://bird.net.au)

Bird Habitat Scores

Bird habitat quality scores at sites on individual surveys ranged from 0 to 25 (mean 4.7), and this maximum score was obtained at 'Kentucky Mac'. Mean scores at sites over all surveys varied between 0 ('Iambi', a paddock in early stages of revegetation) and 11.75 (Conimbla National Park), and 10 sites averaged scores of eight or more.

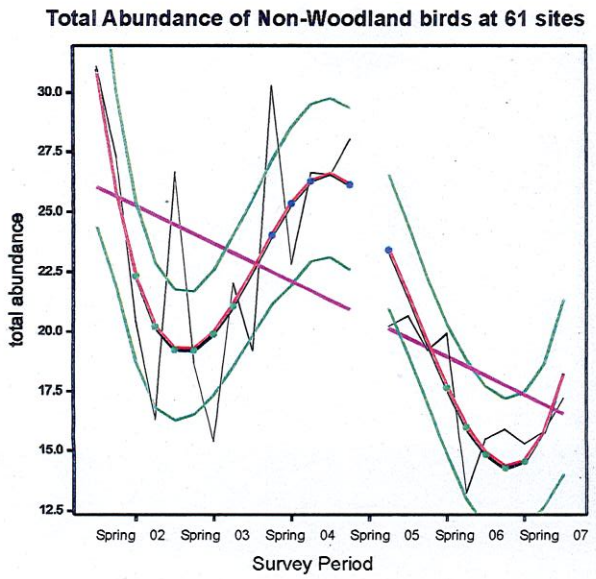
Conclusions and Recommendations

It is fundamentally important to continue monitoring – the longer the time series, the more powerful become the data for inference of trends. The value of monitoring schemes such as this one increases at a disproportionately greater rate as the monitoring continues. Currently, many species and indices show cyclical trends (e.g. Fig. 4a), and over the six years presented here typically one and a half cycles are represented, thus making it difficult to interpret whether the measures are increasing, decreasing or stable. These linear trends, if present, will become readily apparent as more cycles are encompassed.

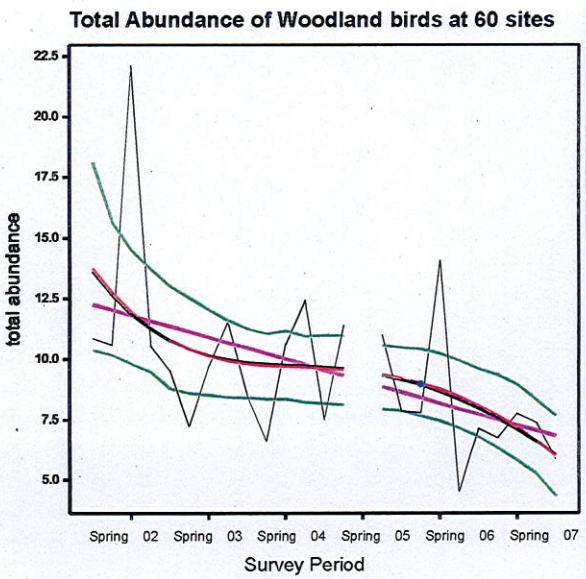
The pervasive decline in the species richness and abundance of woodland-dependent birds over the six years of survey is of grave concern. Most threatened and declining species were detected too infrequently to be modelled individually, but their general decline can be assumed, given their membership in the woodland-dependent group, and most that could be modelled showed evidence of decline. Hence we conclude that greater survey effort including more sites, and more sites with these species in occupation, and a longer survey period is required to accumulate sufficient observations. This will to allow a greater proportion of at-risk species to be modelled and enable greater confidence in the interpretation of their longer-term trends.

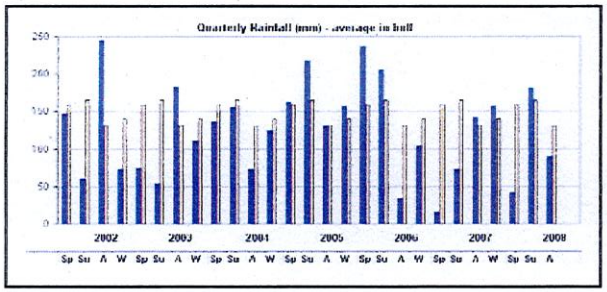
Given the decline in woodland-dependent birds generally, it seems logical that there needs to be a greater focus and investment in restoration/rehabilitation activities, by increasing the area of woodland habitat (revegetation) and improving the condition (suitability) of existing woodland habitat. Recent advances in direct-seeding technology shows that this method works in the Cowra Shire (Geeves *et al.* 2008), and so the rate of revegetation could be dramatically increased. Our bird and habitat surveys over the past six years have shown us which sites are better for woodland birds. Based on these observations and those from similar studies into woodland bird conservation in south-eastern Australia, we can make the following recommendations for landholders interested in reversing the decline in woodland birds.

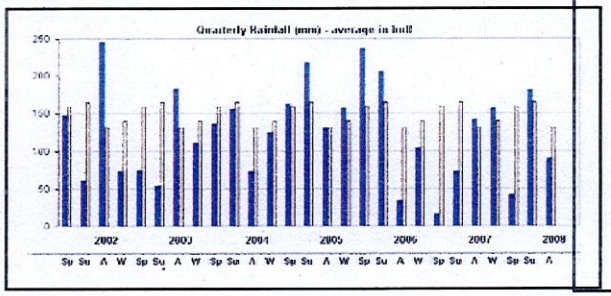
a)



b)







Graphical presentation of results

The results are presented graphically for composite indices (as here) and individual species in the Appendices, as follows:

1. the actual pattern in the reporting rate or abundance over time is plotted as a thin black line (usually highly variable and spikey).
2. the 'smooth fit', represented as a smooth black line, obtained by fitting a regression spline.
3. the average of 100 bootstrap samples is shown as a red line, often superimposed on 'smooth fit' (above).
4. the 5th and 95th percentiles, based on 100 bootstrap samples, are represented by green lines.
5. a linear fit, i.e. a smoothing spline of order 1, is shown as a dashed purplish-pink line, if non-significant. If it is statistically significant (in the upper or lower 5th percentile of the 100 bootstrap linear fits) it is highlighted as a bold, thick, purplish-pink line.
6. 'significant' change points: blue indicates deceleration of the smooth curve, that is, an adverse change; and green indicates acceleration, that is, a favourable change.

Figure 4 - Note the fairly regular spring-summer spike in abundance of woodland bird abundance in most years, compared with the less regular pattern of spikes and troughs in the graph of non-woodland bird abundance. The overriding difference though is the fairly steady decline of woodland bird abundance over the six years of surveys – declining from *ca* 12.5 birds per site at the start to *ca* 7.5 birds per site at the end – compared with the dramatic down- and up-surges in abundance of non-woodland birds, rises and falls which seemingly tracked rainfall trends across the six years.

- ✓ Fence off rivers, creeks and other remnants and manage grazing on these sites. Creeks and rivers have been shown to be very important and contain critical resources for many species, particularly during dryer periods.
- ✓ Increase the amount of native vegetation on farms. It has been shown by numerous studies that total vegetation cover across a landscape has significant impact on bird species diversity.
- ✓ Increase the size of small remnants (to >10ha) through revegetation and fencing (with grazing management) to encourage natural regeneration. The larger remnants are likely to be more resilient to disturbance in the long term and contain more resources for a range of fauna species.
- ✓ Increase the width of narrow plantings and thin linear remnants (e.g. narrow roadside verges) to at least 30 m and five rows of revegetation. More woodland bird species can coexist in broad strips of native vegetation.
- ✓ Encourage increased cover of native ground covers and woody shrubs (especially *Callitris* spp., *Acacia* spp.), except in high quality native grassy woodlands. A diversity of layers (grasses, shrubs, high shrubs, trees) in bushland provides habitat for a range of species for nesting, foraging and cover from predators and pest native species such as Noisy Miners. In addition, when undertaking restoration promote horizontal patchiness within both overstorey and understorey vegetation layers as some birds, for example fairy-wrens and finches prefer dense cover and larger birds such as Grey-crowned Babblers require more open habitat. This will tend to occur naturally if direct seeding is used.
- ✓ Increase the amount of fallen timber, rocks and leaf litter. This provides habitat for insects, spiders, small reptiles and other bird food. It also provides cover and nesting habitat for a range of ground nesting birds such as Painted Button Quail, Speckled Warbler and Bush Stone Curlew. This is why it is important to discourage the removal of fallen timber from woodland remnants.
- ✓ Connect remnants to other woodland areas using corridors, patches of vegetation which act as stepping stones or by protecting existing paddock trees and where possible replanting paddock trees.
- ✓ Increase the use of native pastures as many native species such as Diamond Firetails forage on native grass seed.
- ✓ Protect woodland remnants from fertilizer and pesticide drift as both can impact on understorey plant diversity and can delay regeneration of native species.
- ✓ Protect native vegetation along roadsides and travelling stock routes and manage them appropriately, as these are often the only habitat links for birds and a range of other fauna across cleared productive land.

References

Barrett G.W., Freudenberger D., Drew A., Stol J., Nicholls A.O. and Cawsey E.M. (2008). Colonisation of native tree and shrub plantings by woodland birds in agricultural landscape. *Wildlife Research* **35**: pp. 19 – 32.

Cunningham R. and Olsen P. (2009, in press). A statistical methodology for tracking long-term change in reporting rates of birds from volunteer-collected presence-absence data. *Diversity and Distribution* **15**.

Geeves G., Semple B., Johnston D., Johnston A., Hughes J., Koen T. and Young J. (2008). Improving the reliability of direct seeding for revegetation in the Central West of New South Wales. *Ecological Management and Restoration* **9**: pp. 68-71.

Reid J.R.W. (1999). **Threatened and Declining Birds in the New South Wales Sheep Wheat Belt 1. Diagnosis, Characteristics and Management**. Consultancy Report to NSW National Parks and Wildlife Service. CSIRO Wildlife and Ecology, Canberra.

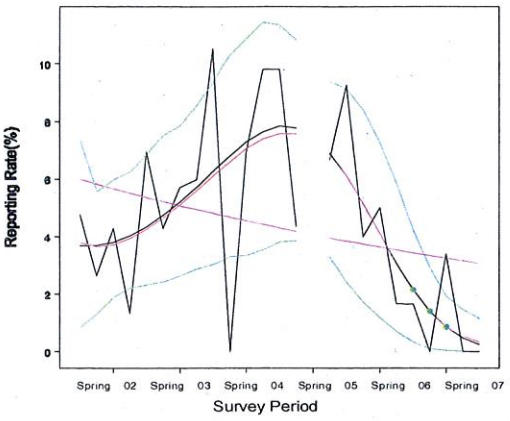
Reid J.R.W. (2000). **Threatened and Declining Birds in the New South Wales Sheep Wheat Belt 2. Landscape relationships – Modelling bird atlas data against vegetation cover.** Consultancy Report to NSW National Parks and Wildlife Service. CSIRO Wildlife and Ecology, Canberra.

Traill B. and Duncan S. (2000). **Status of Birds in New South Wales Temperate Woodlands Region.** Australian Woodlands Conservancy, Chiltern, Australia.

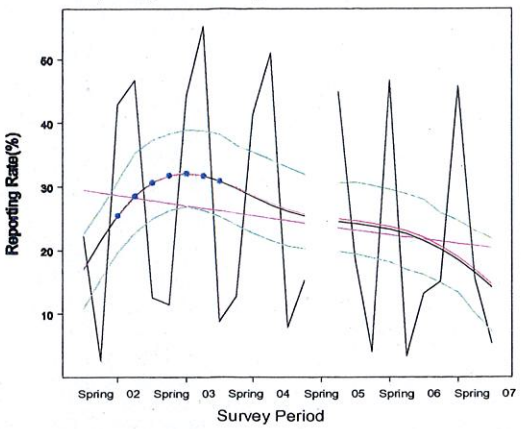
Wilson C.E.V. (2003). **Remnant woodland condition and its influence on woodland species richness and community composition.** B.Sc. Hons. Thesis, SRES, Australian National University, Canberra.

APPENDIX 1 – shows graphs for several threatened and declining woodland bird species where reporting rate (presence/absence response across survey sites during a survey period) was above the threshold for analysis

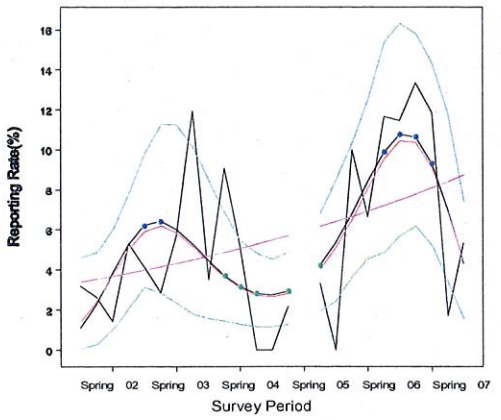
Reporting Rate of Diamond Firetail at all sites



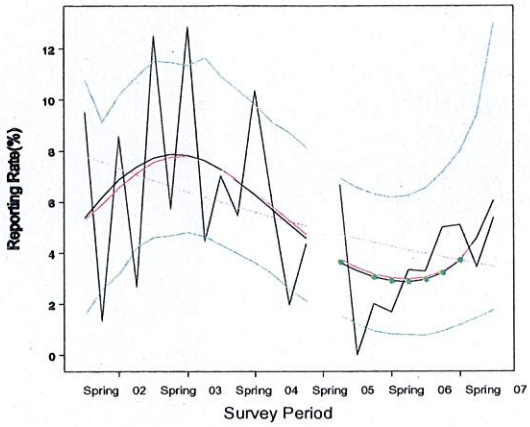
Reporting Rate of Superb Parrot at all sites



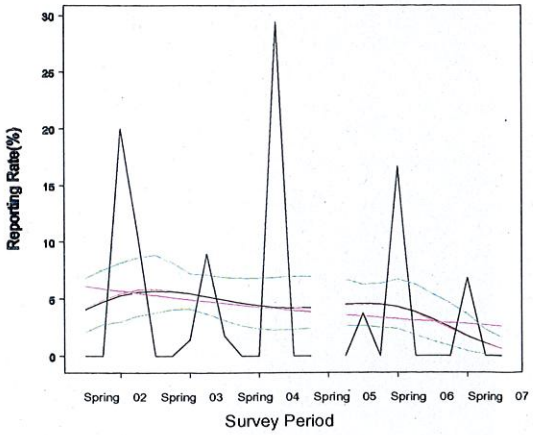
Reporting Rate of Buff-rumped Thornbill at all sites



Reporting Rate of Restless Flycatcher at all sites

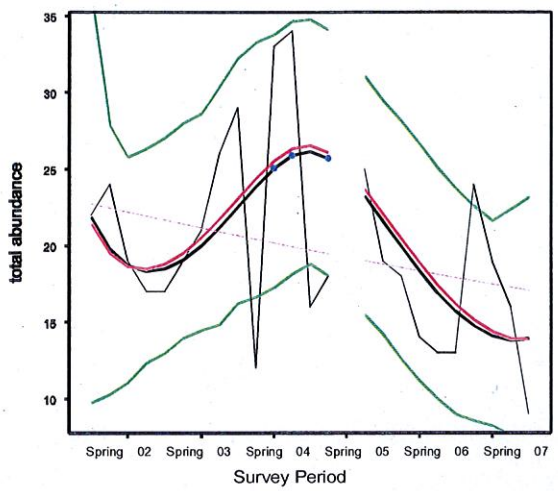


Reporting Rate of White-browed Woodswallow at all sites

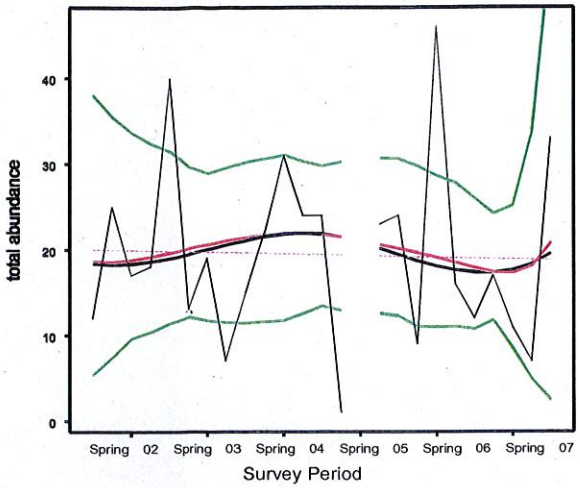


APPENDIX 2 – abundance regression spline models for threatened and declining woodland bird species at those sites where the frequency of detection during surveys was above the threshold for analysis.

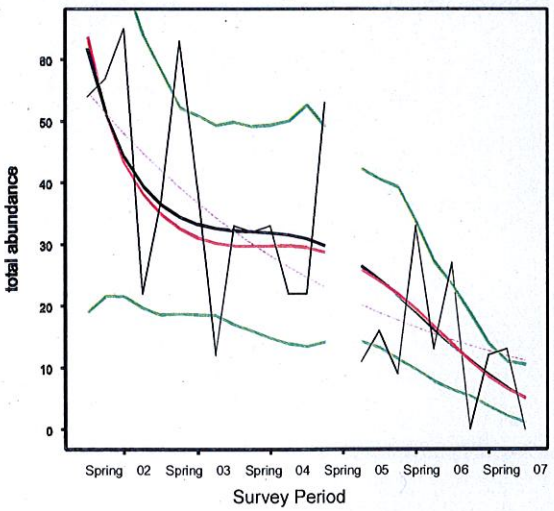
Total Abundance of Brown Treecreeper at 34 sites



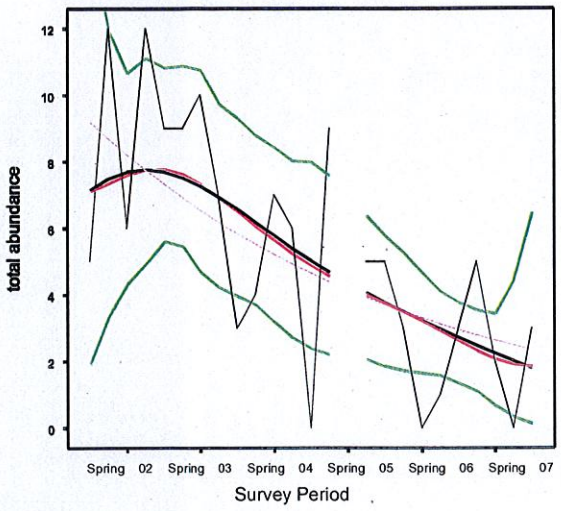
Total Abundance of Grey-crowned Babbler at 25 sites



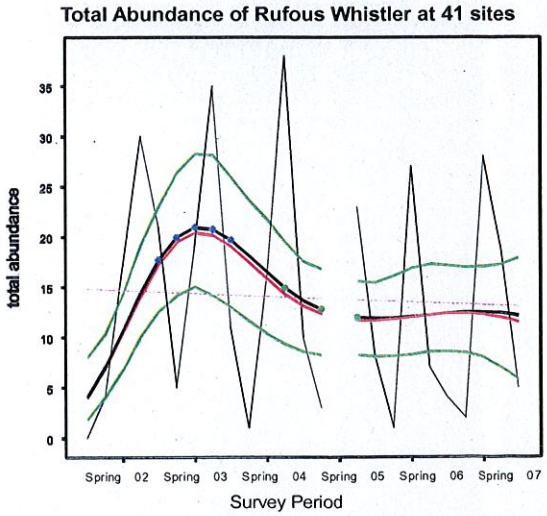
Total Abundance of Dusky Woodswallow at 34 sites



Total Abundance of Crested Shrike-tit at 27 sites



Total Abundance of Rufous Whistler at 41 sites



Note: In APPENDICES 1 and 2 the actual pattern in the reporting rate or abundance over time is plotted as a thin black line (usually highly variable and spikey).

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see http://www.birdsaustralia.com.au/our-projects/cowra-woodland-birds.html for a pdf of the full report.


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