



# **Final report of the National Malleefowl Monitoring, Population Assessment and Conservation Action Project**

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## Preamble

The multi regional “National Malleefowl Monitoring, Population Assessment and Conservation Action Project” was a two year (2006-2007) NHT funded project that implemented key components of the National Malleefowl Recovery Plan. The general aims of the project were to:

- Collate existing Malleefowl monitoring data for analysis
- Interpret breeding density trends in the light of management practices and environmental variables
- Develop a consistent national monitoring system and a national database, and foster on-going and self-sufficient monitoring that facilitates government, private and community monitoring programs.
- Develop the monitoring program in the future so that management actions that are most beneficial to Malleefowl conservation can be identified and demonstrated, and integrate this knowledge into outcomes for conservation on private and public land across Australia.
- Involve all stakeholders in this project and provide advice to regional NRM bodies on how best to promote Malleefowl conservation within their region, and an education package for primary schools.

In addition to these national aims, more local aims included:

- The establishment of four new monitoring sites in Vic and SA,
- Fencing of remnant Malleefowl habitat in Eyre Peninsula, SA, and
- Support for the WA Malleefowl Network to hold a National Malleefowl Forum in Katanning, WA

All of these aims have been achieved, highlights including the development of a detailed manual developed by community volunteers, thorough analyses of past monitoring data, a professionally designed education package for primary schools, and comprehensive information package for NRM bodies.

This project was funded by NHT and administered by the Mallee CMA in Victoria. The VMRG were contracted to undertake the national projects and were assisted by a large number of people from community groups and government departments across Australia. The Mallee CMA contracted state based organization

## Background

Within the past century the range of Malleefowl has contracted, particularly in arid areas and at the periphery of its former range, and severe declines have occurred in southern agricultural areas due to the clearing of the mallee for wheat and sheep production (Benshemesh 2005). The fate of Malleefowl within the remaining habitat is uncertain and declines have been described in many protected areas across Australia (Brickhill 1985, 1987, Priddel 1989, 1990, Priddel and Wheeler 1995, 2003, Benshemesh 2007b, Priddel et al. 2007), and the species is regarded as threatened in every state in which it occurs and is listed as Vulnerable nationally. While land

management agencies and individuals grapple with ways of reversing these declines, few techniques have actually been proven to be effective and there remains considerable uncertainty about how best to benefit the species.

Against this worrying backdrop, the role of monitoring has become central to the Malleefowl conservation effort. Formal Malleefowl monitoring programs started in most states in the late 1980s and early 1990s, and provide fundamental information on trends in Malleefowl abundance at a number of sites across Australia. This information is needed in order to assess the conservation status of the species across their range and to identify areas in which the species is declining. Perhaps even more importantly, monitoring provides a means of measuring the effects of naturally occurring events and the effectiveness of management actions on Malleefowl numbers.

Monitoring populations involves obtaining reliable and repeated measures of their numbers in order to measure changes in population size. Malleefowl are shy and elusive birds and counts of the birds themselves is very difficult, but their mounds are conspicuous and provide a reliable means of measuring the abundance of breeding birds in areas where they are moderately common (Benshemesh 2004). This is because Malleefowl tend to renovate old mounds rather than construct new mounds afresh each year (Frith 1959), so that each old mound is a potential site for breeding. Annually checking the known mounds each spring thus provides a good estimate of the trends in breeding numbers at each carefully delineated site. New mounds are occasionally built by the birds and a thorough re-search of monitoring sites is required every few years to capture these and ensure accurate estimation of breeding numbers.

Monitoring Malleefowl is well suited to volunteer involvement and volunteers have made, and continue to make, an enormous contribution to Malleefowl conservation through monitoring programs. In fact, most monitoring that occurs across Australia is undertaken by volunteers and in many areas volunteers are responsible for all aspects of organizing and conducting the monitoring, including data storage, vetting and analysis. Numerous volunteer groups, as well as government and non-government agencies, and individuals are involved in this effort and maintaining standards and efficiency in the face of this diverse interest has become a major challenge. Indeed, it was clear at the National Malleefowl forum held in Mildura (Vic) in 2004 that the monitoring effort was severely fragmented across Australia and that monitoring methods varied, making comparisons difficult. Moreover, although there were nominally nearly 100 monitoring sites across Australia, there was no central list, let alone data that could be readily accessed, and after several decades of dedicated effort by volunteers and government agencies much of the data was not collated, verified or analysed.

In acknowledgment of this growing problem, one of the main aspirations voiced at the Malleefowl forum in Mildura in 2004 was to standardize, consolidate and analyse the monitoring at a national scale and to move toward a more dynamic phase in which monitoring is used to assess management in regard to its benefit to Malleefowl (Victorian Malleefowl Recovery Group 2004). In response to this wide community support, an application to NHT was developed by Julie Kirkwood of TSN (Threatened

Species Network) in collaboration with community groups, state and regional authorities from around Australia, and the Malleefowl Recovery Team. The application addressed much of Action 9 of the National Malleefowl Recovery Plan and was successful: two years of funding was granted for a range of office-based and on-ground works. Work on the "National Malleefowl Monitoring Population Assessment and Conservation Action Project", which became known simply as the 'multi-regional Malleefowl project', started in 2006 administered by the Mallee CMA (Victoria) in collaboration with the VMRG (Victorian Malleefowl Recovery Group) and guided by a national steering committee on which all monitoring groups were represented.

This is the final report of the project and outlines the main achievements over the past two years. A large number of people from volunteer groups, government and non-government agencies collaborated on this project and much of the success of this project was due to the high degree of cooperation and enthusiasm with which they contributed. Indeed, the renewed spirit of cooperation and common aims across organizations and the continent is perhaps one of the greatest achievements of the multi-regional Malleefowl project.

## **Milestones and other achievements**

### ***Data collation report***

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J Benshemesh, submitted on 12/4/06

One of the first tasks in the multi-regional project was to collate and review the data that had been collected to date. Collating the data turned out to be surprisingly difficult (Benshemesh 2006a) despite the willingness of data custodians, because data sets were often fragmented and were not readily accessible even within individual states or regions. Much of the data existed only on paper and was entered onto databases for the current project by teams of volunteers, while some original records could not be located at all. These difficulties in collating the monitoring data were frustrating, but most importantly also demonstrated to all involved in the monitoring that there was an urgent need for improvement in data management and strengthened the resolve to work toward a national database for Malleefowl monitoring records.

### ***Gap analysis***

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J Benshemesh, submitted on 9/6/06

A 'gap analysis' of the collated data was performed (Benshemesh 2006b) which examined the gap between the available data and the data we expected or would reasonably have liked to have for the two main tasks ahead: reviewing the effectiveness of the data routinely collected in the Malleefowl monitoring program, and analyzing the trends in Malleefowl in regard to environmental variables. While over 20,000 mound visits had been recorded across Australia, the gap analysis basically looked at what was missing and how useful the data sets in their various forms were likely to be. For example, a relatively common problem in some datasets was that they were incomplete because observers only visited a portion of the mounds known in an area during a particular season. This meant that the actual

number of breeding Malleefowl at a site was uncertain, and in some severe cases this rendered the data set useless for trend analyses. Overall, the assessment of the strengths and weaknesses of the collated data proved helpful for developing national standards (see below).

Apart from systemic problems in some monitoring data sets, it was also clear that information on past management practices (such as fox control) were difficult to obtain from state agencies and that it would be worthwhile for the Malleefowl monitoring program to obtain these records each year, and perhaps also monitor important environmental factors such as the abundance of predators and herbivores, food availability and habitat changes.

## **Trend Analysis**

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J Benshemesh, Richard Barker and Ryan Macfarlane, submitted 5/12/06;  
revised 4/7/2007

A major aim of the multi-regional Malleefowl project was to collate and analyse the data on Malleefowl trends that had been collected to date. This data had accumulated since the late 1980s when monitoring programs were initiated in most states, but had never before been collated let alone collectively analyzed. This rich treasure of data describes the trends of Malleefowl at numerous monitoring sites in NSW, SA, VIC and WA over many years, and thus shows the influence of environmental factors (such as rainfall) and management actions (such as fox control) may have had on Malleefowl populations. After thoroughly vetting and screening all the data on Malleefowl trends from the national monitoring effort, we were left with high-quality data from over 60 sites across Australia spanning up to four decades and representing 590 counts of Malleefowl breeding at sites (and over 20,000 mound inspections). However, the data-set was also complex due to the variable amount and quality of data from each site, and consequently sophisticated statistical analysis was required. This expertise was provided by prominent wildlife statistician Professor Richard Barker (University of Otago, New Zealand) who undertook the analysis with his student Ryan Macfarlane using a statistical modelling technique known as hierarchical Poisson (loglinear) regression.

While the main body of data comprised annual counts of mounds that were used for breeding each year for each of these monitoring sites, we also collated information regarding fox control efforts, rainfall, landscape fragmentation, and fire history in order to examine the effects of these variables on Malleefowl breeding numbers. Many people contributed to this pooling of information, including Sharon Gillam and Peter Sandell (fox control), Dr Kate Callister (fire history), Roman Urban (fragmentation), Dr Graham De Hoedt (rainfall modelling), as well as numerous rangers, land managers/holders and volunteers. A few of the monitoring sites considered in this study were within landscapes that are known to have sizeable goat and/or kangaroo populations, but we were unable to obtain reliable information on the abundance of these grazers/browsers at many sites and were unable to examine the possible effects in our analysis. Most of the monitoring sites are within reserves, and none was believed to be routinely grazed by sheep.

The analysis (Benshemesh et al. 2006) showed that, on the whole, Malleefowl have declined nationally even in reserves set aside for their protection. This downward trend was most evident in SA where the decline was statistically significant, and WA where it was not significant (possibly due to low sample sizes). In VIC no clear trend was evident despite the large number of sites and monitoring records. In NSW we found a significant positive trend in Malleefowl, although we only obtained monitoring data from two reserves in the SW corner of NSW (Tarawi and Mallee Cliffs); elsewhere in central and western NSW several studies have documented declining breeding numbers, especially in very small (<500 ha) isolated remnants and it would appear that the Malleefowl trends in Tarawi and Mallee Cliffs are an exception in NSW and not representative of the remainder of that state.

Of greater interest were the results of the analysis of the environmental factors that were associated with these population trends. Populations go up and down for a variety of reasons, and the large amount of data that was collated for this project provided a unique and powerful opportunity to identify which factors were most responsible for the Malleefowl trends at the 64 sites in the analysis. This number of sites and seasons is necessary to distinguish with any confidence between different factors operating in differing geographic and climatic regions.

In short, we found that while fire history and landscape configuration had effects on Malleefowl trends, in our sample of sites these were not as important as rainfall in explaining past trends in Malleefowl numbers. Winter rain was shown to have a pronounced and profound affect on Malleefowl breeding numbers and this was evident in our analysis. Significant lag effects were detected for up to four years (we did not test beyond 4 yrs), meaning that the number of Malleefowl breeding at a site is influenced by the winter rainfall not just in the current year, but in the previous four years (at least). We suggest this may be related to food production, recruitment of young into the breeding population, or both of these factors.

The importance of this finding can hardly be overstated. Lower than expected winter rainfall has characterised most monitoring sites over the past decade or so, and may provide an explanation for the declines in Malleefowl described in this study. More than 80% of the sites in this study experienced lower winter rain over the past 10 years, and 95% over the past five years, compared with long term averages between 1961-90 (a period which is accepted as a recent meteorological standard). Given the significant relationships between winter rain and Malleefowl numbers, current predictions of climate change for Australia provide considerable cause for concern.

The most surprising result from our analysis concerned the effect of fox control and fox abundance on Malleefowl breeding populations. While there is no doubt that foxes eat Malleefowl, the degree to which predation by foxes influences Malleefowl numbers has long been controversial and unresolved. This study represented the first attempt to examine this question at the population level across multiple sites. As baiting with 1080 is generally used to control foxes, we estimated the number of baits laid each year within a 100km<sup>2</sup> area with the monitoring site at its centre to provide an index of fox control intensity. Such an area is generally regarded as a minimum for

effective fox control. To estimate the affect of fox control on fox abundance, we used data on the frequency of fox scats on Malleefowl mounds; these data were routinely collected in SA and Vic since the early 1990s.

Our analysis showed that while baiting was associated with a decline in fox scats on mounds, there was no evidence that fox control, as it has been practiced over the past two decades around Malleefowl monitoring sites, has benefited Malleefowl breeding numbers or ameliorated declines. The failure of any clear response by Malleefowl to fox baiting indicates that we have placed too much emphasis on fox control and not enough effort has been directed at discovering the true causes of decline or to find ways of benefiting wild populations.

### ***Review of the routinely collected data: streamlining and justifying the monitoring***

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J Benshemesh, submitted on 17/5/07

The primary aim of the Malleefowl monitoring program is to track changes in the number of birds inhabiting specific areas. Observers (mostly volunteers) examine and categorise all the known mounds at each site as either 'active' (currently used as an incubator) or not active (Patford et al. 2004). To enable vetting of records and the detection of errors in judging the activity of mounds, the size, shape and appearance of mounds is also described each time a mound is visited. These descriptors have been defined and used in both Victoria and South Australia from the early 1990s and in WA since 2005.

Few changes have been made to the monitoring protocols since the early 1990s. This conservatism was necessary to enable comparisons through time, but also meant that some unnecessarily data may have been retained in the protocols which provided little useful information. Also, new technologies over the past decade or so have changed the ways that data may be validated and reduced the need for some types of descriptive data. GPS, digital photography, and digital data-capture using Palm handheld computers and Cybertracker software have all been introduced to the monitoring program since 2001. These recent changes, and the goal of a unified national Malleefowl monitoring approach, made a review the usefulness of monitoring data timely and provided an opportunity to consider improvements. The review (Benshemesh 2007c) provided a basis from which to assess the merits of the data routinely collected and examined on the data collected in Victorian since 1995 which provided a consistent and detailed data set. The steering committee identified five questions which provided a focus for the review:

- Are the descriptors useful in validating/vetting records of active nests?
- Do the descriptors tell us much about how long it has been since a mound was active?
- Could the efficiency of the monitoring program be improved by omitting very old mounds, or would this compromise the accuracy of the monitoring?
- How often should sites be re-searched?
- Are data on animal signs at mounds useful?

In short, the review found that while the data were of a high standard and captured a large amount of information, it is not necessary to collect all the descriptive data at mounds every year and a number of changes were suggested. Simplifying and streamlining the monitoring process will also be beneficial by placing further emphasis on the most important measures, and the volunteer time and effort that is saved could be used more productively to measure other variables of interest such as habitat quality or predator numbers. Criteria were also developed for identifying mounds that were unlikely to be used again and, if necessary, these mounds could be omitted from annual monitoring with little sacrifice to the accuracy of breeding numbers counts. It was also argued, on the basis of the data examined, that the recommended interval for re-searches of monitoring sites be changed from 3-5 years to 5-10 years, except in situations where there maybe a shortage of old mounds suitable for renovation at a time when Malleefowl numbers are increasing (this often occurs 20-30 years after fire).

We expect the streamlined protocols to be in national use for the 2008/9 monitoring season.

### ***Monitoring manual***

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Peter and Ann Stokie (and Malleefowl monitoring volunteers from around Australia), submitted on 30/4/07

A major achievement of the multi-regional Malleefowl project has been the development and publication of a thorough national Malleefowl monitoring manual written by representatives of monitoring groups from around Australia (NHT National Malleefowl Monitoring Project 2007). This was a democratic process guided by Ann and Peter Stokie who brought representatives together in round-table discussions and collated and circulated their contributions. The production of the manual tapped into the collective experience of a large number of people, as well as the analyses outlined above, and was achieved by consensus. Two large national meetings, one held in Melbourne and one in Adelaide, were attended by representatives from Malleefowl volunteer groups, government environment departments and non-government environment groups. At these meetings, trust and acceptance in the process led to an outstanding level of contribution for all. The views of individuals were recorded and used in the subsequent development of the National Manual through group emails and discussion. It was important that all those who wanted to contribute had every opportunity to do so, and the end result was a truly consensus document which outlined agreed processes and practices for the future (see below).

The size and complexity of the manual gave it a somewhat intimidating presence, and it was decided to employ the skills of a designer (Ms Robyn Adderly) to provide it with a friendlier appearance. The final manuscript was edited by a VMRG volunteer (Liz Hopkins), and the design and production of the manual was overseen by another volunteer (Eliza Stokie).

The National Manual for the Malleefowl Monitoring System was officially launched by the Chair of the National Malleefowl Recovery team at the National Malleefowl Forum in Katanning WA in September 2007. One of the main resolutions arising from the forum was that future monitoring will comply with the national standards.

## ***Evaluation/trial of monitoring manual***

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Peter Stokie, submitted on 31/7/07

After the national monitoring manual was completed and distributed to representatives in each state, we began a three month review of content and trailing of concepts and systems outlined in the document. At the end of this period, those undertaking the trial were asked to respond to a comprehensive 55-question survey to assess whether the content adequately described the various tasks in sufficient detail, how useful and usable the content was, and whether there were any obvious omissions in the draft document (Stokie 2007b). Participants were asked to assess how well the content reflected their views and rate the level of consultation that occurred in the formulation stages of the document. Apart from being provided with a copy of the draft manual, reviewers were also informed of the content and recommendations of the review of data routinely collected (above) which were incorporated into the manual.

The survey revealed that respondents were very satisfied with the content of the manual and the processes involved in producing it: participants were unanimous that an adequate level of consultation had occurred, and there was almost total agreement in the content of the manual. In the few cases where respondents raised issues in the survey, their concerns were addressed and incorporated into the final document. The finalised National Manual for Monitoring Malleefowl was thus shown to faithfully reflect the views of participants from each of the states involved in the development of the manual.

## ***Training***

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Ann Stokie, submitted on 30/4/07

Training of volunteers has taken a number of different forms, ranging from the formal involving relatively large numbers of people in tightly structured meetings, to the very informal with a one-on-one consultancy. The training and skills instruction undertaken by the VMRG may be broadly grouped into four categories:

1. Broad scale training in the field with large groups concentrating on using technology to monitor Malleefowl mounds, and how to read and interpret a Malleefowl mound.
2. Training-the-Trainers programs involving smaller groups more specifically focused on the delivery of concepts and materials to volunteers and data management.
3. Training community groups to search monitoring sites and establish new sites, monitoring in these sites, and recording information on Palm hand held computers running special sequences for searches.
4. One on one training with volunteers who have particular difficulties, or special responsibilities, such as involvement with data management.

Training of one sort or another has been held in all states in which Malleefowl monitoring occurs, to a diversity of interest groups, and in a diversity of locations including remote regions such as the Warburton Aboriginal Community in Western Australia.

Eighteen formal skills and training events have been held over the duration of the multi-regional Malleefowl project and there have been over 500 participants in these training events (Stokie 2007a). In addition, a good deal of less formal training has occurred via email and telephone. People from all states have generously shared their skills and this has greatly benefited all concerned.

### ***Report on establishment of 4 sites in Victoria***

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Peter Stokie, submitted on 14/9/06 and 31/7/07

As reported in two separate Milestone reports, four new sites were established in Victoria over the duration of the Multi regional Malleefowl Project (Stokie 2006, 2007c). Each of these sites was located in areas where Malleefowl were known to exist, but where monitoring was not occurring. Two sites were in the vicinity of the Little Desert, at the Nurcounng Flora Reserve and near Broughtons Waterhole south of Nhill. A third site was on the southern edge of the Big Desert at Broken Bucket Nature Reserve. A fourth site was established in the Paradise Flora and Fauna Reserve at the southern edge of Wyperfeld National Park. In total, more than 83 different individuals were involved and in excess of 750 hours of volunteer hours for the search, and many more hours of travel time. Each of these new sites has been monitored in 2007/8 by the VMRG in line with national standards.

Each of the new sites was established entirely by volunteers, coordinated by the Victorian Malleefowl Recovery Group. Due to the difficulties of thoroughly searching thick scrub, large groups of volunteers were needed for several hours over many days for each of these sites. Most of the volunteers involved in the searches had no previous experience with Malleefowl and in some cases volunteers had never been in mallee scrub off tracks.

The VMRG developed a training package that provided volunteers with the skills they need for a safe, effective and efficient search, and conducted this training immediately before each search began. Apart from training and supervision, the VMRG also provided GPS units pre-loaded with search waypoints, palm computers, customised Cybertracker sequences, maps and communications equipment for the searches.

An exciting aspect of establishing the new sites was the broad range of groups involved which included the Hopetoun Pre-School and Kindergarten Parents Group, SES Nhill, Natimuk Urban Landcare Group, Victorian Malleefowl Recovery Group members, and Friends of The Simpson Desert (on tour in Victoria). Through funding provided by the multi-regional project, the VMRG was able to provide funding to cover all travel expenses, camping costs and food costs for the each of the groups. Remarkably, each of these groups used the search as a fundraiser and no personal expenses were taken: all money paid out to the groups was donated to the Pre-school arts and materials fund, the SES Building fund and the Natimuk Bush Hospital Auxiliary.

There was considerable interest from the local press in each of these searches and three separate articles appeared in local country newspapers.

## ***Education package***

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Tim Byrne, Ralph Patford, Ann Stokie, and Peter Stokie; Submitted on 28/9/07

An important task involving community volunteers was the establishment of a trial Malleefowl education package (Byrne 2007). A dedicated sub-committee of interested VMRG members developed a list of ideas that could be incorporated into an education package for use in schools. We were fortunate to have these ideas developed by an experienced Primary Science teacher, Mr Tim Byrne, who previously developed teaching materials for Scienceworks in Melbourne. Mr Byrne designed the Malleefowl education package as an interactive CD of activities based lessons and experiments involving Malleefowl and other related animals for Senior Primary levels with some activities suitable for younger students. All activities are linked to existing Curriculum Standards Frameworks and Victorian Essential Learning Standards, with easy to follow guidelines for teachers to monitor levels covered. Curriculum areas concentrate mainly on science, but mathematics, geography, environment and English are an integral part of the package.

Many of the activities require computer based research as well as 'in the field' excursion type activities. Apart from providing an introduction to Malleefowl and its conservation, student activities are included to illustrate interesting attributes of feathers, eggs, incubation, camouflage, and tracking, as well as concepts such as threatened species, monitoring, and examining problems from several points of view (eg. de Bono's thinking hats).

The education package has been completed and is currently being trialled: the package has been distributed to 8 Primary Schools in South Australia and 6 Primary Schools in Victoria, and a Home Schooling teacher. With 14 schools and up to 200 upper primary students involved in the trial, an immediate most positive outcome will be raised awareness of the circumstances of Malleefowl, and the state of the environment in general. However, the main purpose of the trial is to evaluate and improve the package with feedback from the teachers and principals. Accordingly, the VMRG will send the schools a comprehensive evaluation survey which the teachers and principals will fill out, and the schools will also provide us with photographs or samples of student work. Following a review of the evaluation surveys and an assessment of the effectiveness of the package, it is envisaged that the package will be modified and improved. The intention is to produce a product that will be suitable for use in all primary schools, particularly in the Victorian Mallee and Wimmera, and in South Australia. The VMRG is considering launching the education package on Threatened Species Day in September 2008 with the help of WWF Australia.

## ***Advice to Regional Natural Resource Management Bodies Regarding Management and Monitoring of Malleefowl.***

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J Benshemesh, submitted on 26/8/07, revised and printed January 2008.

NRM bodies (also called Catchment Management Authorities or Catchment Councils) have become major conduits for conservation funds flowing from commonwealth agencies, and while there are advantages of this regional focus, there is also a danger that large scale conservation programs will suffer unless NRM bodies are made aware of these programs and work collectively

and collaboratively toward common goals. In a sense, bureaucratic and administrative fragmentation threatens Malleefowl conservation as much as geographic fragmentation.

The final phase of the multi-regional project was to provide a concise report advising Natural Resource Management (NRM) bodies on management of Malleefowl within their regions, and providing them with brief summaries of Malleefowl records, monitoring sites and major issues in each region (Benshemesh 2007a). There are about 15 NRM regions that contain Malleefowl monitoring sites, out of about 20 in which Malleefowl occur. The report advises these organizations of the central importance of monitoring in the Malleefowl Recovery Team's plans to implement adaptive management across monitoring sites. For these plans to be realized, a high degree of collaboration across regional NRM bodies will be required, and the main purpose of this document is to lay the foundation for this collaboration.

Given the need to engage the attention NRM officers and others across the nation, the skills of a designer (Ms Robyn Adderly) were employed to improve the appearance of the report and in February 2008, 40 high quality copies were distributed to NRM bodies and key individuals across Australia. The design and production of the report was overseen by a VMRG volunteer (Ms Eliza Stokie) and funded by the Mallee CMA.

## **Conclusion**

The multi-regional Malleefowl project has been a landmark program that has organized and improved the monitoring of Malleefowl across Australia and has laid a firm foundation for developing improved management of Malleefowl. What two years ago often appeared hopelessly disorganized, disparate, and inaccessible, has been fashioned into a unified and well-defined national monitoring system for Malleefowl breeding numbers. This change has been produced by the people who undertake the monitoring, mostly community volunteers, rather than being imposed upon them. The result is a renewed spirit of common purpose and a determination to undertake the monitoring that we believe will sustain the groups for many years to come.

Other achievements of the multi-regional project include the collating of past records into the first national database of Malleefowl monitoring, and the analysis of these records in terms of the likely causes of declines. We have reviewed our methods in light of the information that has been collected in the past, and modified our methods accordingly. Many hundreds of people have been trained, and many more again involved in a range of volunteer activities. An education package has been produced that is of a high professional standing, and a concerted effort has been made to involve a diversity of land managers across the nation.

At the core of all of these activities is an earnest desire to improve the conservation of Malleefowl. Monitoring has occupied a central position in this project precisely because community groups provide an enormous contribution to Malleefowl conservation by monitoring trends in the species populations at a diversity of sites. Monitoring supplies the crucial feedback we need to assess the effectiveness of management actions, as well as the

conservation status of the species. Without this feedback, management is blind.

While the monitoring has already proven to be of great value of to Malleefowl conservation through the trend analysis which formed part of the multi-regional Malleefowl project, to fulfill its potential the monitoring system needs to be integrated with management and research. This could be achieved by adopting an active adaptive management (AM) approach using the monitoring sites to provide a framework for the monitoring effort at a national level and to better integrate monitoring, management and research. AM is a pragmatic and collaborative process of 'learning by doing' that confronts uncertainties in management and seeks to gain reliable knowledge through experimental management. Key components of the AM approach include experimental design and modeling, field management treatments and monitoring, structured in such a way that the success of management alternatives can be evaluated with confidence. Management actions that are proven to be effective are adopted, and in the case of Malleefowl may be applied broadly or at least where they are most needed.

AM is an approach is well-suited to Malleefowl conservation for a number of reasons, not least of which is the uncertainty about the effectiveness of many management actions, and the fact that monitoring is already operational, standardized and unified at more than 80 sites across Australia and is undertaken by an army of volunteers. Monitoring is often regarded as the most expensive part of carefully designed management experiments, and the fact that this hurdle has already been jumped makes an ambitious AM plan all the more practicable.

This project has laid the foundation upon which an AM system can be built. As a follow on from the multi-regional Malleefowl project, we are currently collaborating with scientists and mathematical modelers from the Applied Environmental Decision Analysis (AEDA) research hub and Arthur Rylah Institute (Melbourne) to develop a suitable framework for AM using the monitoring sites. This work is being funded by DEWR, and once this framework is complete, we hope to involve all stakeholders in discussion, planning, and implementation. The NRM bodies have been advised of these developments, and that further collaboration between community volunteers, land managers, scientists, and other stakeholders will be required across political boundaries to develop and implement an AM plan for Malleefowl management.

Another follow on from the multi-regional Malleefowl project involves the development of a web-based, interactive database which will help organized the national monitoring effort as well as store data and provide customized reports to all stakeholders. The need for better data management for all Malleefowl monitoring groups has been clear since we first tried to assemble the past records, and although the data have now been centralized in a database, a much more sophisticated system is required to allow monitoring groups to sustain their effort, and for the data to be maintained and readily accessed. DEWR is funding the new database, and it is scheduled to be trialed during the 2008/9 monitoring season.

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\* references marked with an asterisks were outputs of the multi-regional Malleefowl project.