DEPARTMENT OF
SUSTAINABILITY AND ENVIRONMENT

Flora & Fauna Guarantee Action Statement

#59

This Action Statement was first published in 1994 and remains current. This version has been prepared for web publication. It retains the original text of the action statement, although contact information, the distribution map and the illustration may have been updated.

© The State of Victoria, Department of Sustainability and Environment, 2003

Published by the Department of Sustainability and Environment, Victoria.
8 Nicholson Street,
East Melbourne,
Victoria 3002 Australia

This publication may be of assistance to you but the State of Victoria and its employees do not guarantee that the publication is without flaw of any kind or is wholly appropriate for your particular purposes and therefore disclaims all liability for any error, loss or other consequence which may arise from you relying on any information in this publication.

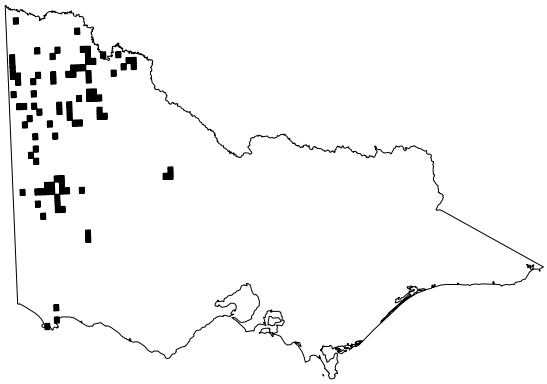
ISSN 1448-9902

Victoria
The Place To Be

Malleefowl

Leipoa acellata

Malleefowl *(Leipoa acellata)*
(Illustration by John Las Gourgues)



Distribution in Victoria (DSE 2002)

Description and Distribution

Malleefowl (*Leipoa ocellata*) are medium-size (about 1.7 kg), fowl-like birds belonging to the family of megapodes, or mound-builders. The megapodes are unique amongst birds in that their eggs are buried and incubated by external sources of heat (i.e. heat from the sun, geothermal activity, or decomposing leaf litter). The group is mostly confined to moist, warm forests of the Australasian region where such external sources of heat are readily available. Malleefowl differ from all other extant megapodes in that they are largely confined to the semi-arid and arid regions of southern Australia, and have evolved the most sophisticated method of mound construction and incubation of all megapodes (Frith 1956a, 1962b).

Malleefowl are ground-living birds that roost in trees, otherwise rarely flying unless disturbed. They are generalist feeders, eating mostly herbs during the winter and spring (Frith 1962a, Benshemesh 1992a), and seeds and invertebrates during the summer and autumn (Frith 1962a, Booth 1986, Brickhill 1987b).

Malleefowl show little sexual dimorphism and are usually monogamous (but see Weathers et al. 1990), probably pairing for life (Frith 1959). Construction and maintenance of the incubator-mound occupies the birds for 9-11 months per year. Mounds are usually about 4 m in diameter and up to 1 m high.

Egg laying usually starts in September when the internal temperature of the mound is suitable for incubation. Eggs are laid at 5-7 day intervals until January in most years, although laying may continue into March in unusually mild seasons (Frith 1959). About 15-20 eggs are usually laid per nest with hatching success typically as high as 80% (Booth 1987a, Benshemesh 1992a) unless mounds become saturated (Brickhill 1986) or are raided by Red Fox Vulpes vulpes (Frith 1962b). Chicks dig themselves out of the mound and are amongst the most precocial birds known; they receive no parental care, can run swiftly almost immediately after

emergence from the mound and fly within a day (Frith 1959, 1962b).

Malleefowl are found predominantly in mallee eucalypt shrublands, but also occur, or once occurred, in a range of other shrubland communities on sandy soils (see Garnett 1992a). Breeding densities are highest in habitat that has not been burnt for at least 40 years (Woinarski 1989, Benshemesh 1990, 1992a), with breeding rarely occurring in habitats that have been burnt within 15 years (Tarr 1965, Cowley et al. 1969).

The historical distribution of the Malleefowl covered much of the southern half of the continent from the west coast to the Great Dividing Range in the east (Blakers et al. 1984). The species was known from numerous localities in the Northern Territory as far north as the Tanami Desert (Kimber 1985) and appears to have been widespread in every mainland state except Queensland. In Victoria, the species was widespread in mallee shrublands in the north-west of the state, in central Victoria, and as far south as the Brisbane Ranges and Melton near Melbourne (Campbell 1884, 1901, Mattingley 1908).

Within the past century, Malleefowl have undergone a marked reduction in their range.

The species has declined in every state in which they previously occurred (Blakers et al. 1984) and are believed to be extinct in the Northern Territory (Blakers et al. 1984, Kimber 1985). In Victoria, Malleefowl are now largely restricted to remnants of their habitat in the north-west of the state, although an isolated (and declining) population exists at the Wychitella Flora and Fauna Reserve in central Victoria (Gell 1985, Benshemesh 1989). The species no longer occurs south or east of Wychitella.

Conservation Status

Current Status

Endangered Species Protection Act 1992 natinal listing	Endangered
CNR (1993) Victoria listing	Vulnerable
SAC (1991)	Threatened

The Malleefowl has been listed as a threatened taxon on Schedule 2 of the Flora and Fauna Guarantee Act 1988.

Reasons for Conservation Status

Clearing of mallee habitats for agriculture has been largely responsible for the decline of Malleefowl (Frith 1962a), and many populations are now confined to isolated remnants of habitat (Gell 1985, Brickhill 1987b, Korn 1989, Benshemesh 1989, Saunders & Curry 1990, Brandle 1991). Large reserves, where they exist, are mostly in low rainfall areas and on poor soils that are unsuitable for agriculture (LCC 1987); they usually contain low densities of Malleefowl.

The introduced Red Fox is known to prey on all stages of the life cycle of Malleefowl, and is considered the major threat to the conservation of the species in NSW (Priddel 1989).

The extent and frequency of fires pose a serious threat to the conservation of Malleefowl as remaining populations may be destroyed and habitat quality reduced for 40 years or more (Woinarski 1989, Benshemesh 1990, 1992a). The effect of fire is exacerbated by the fragmentation due to clearing, as isolated reserves that are entirely burnt are unlikely to be recolonised.

In NSW the remaining population of Malleefowl has been estimated at 750 pairs (Brickhill 1987b). There have been no detailed estimates of the total Victorian population, although it may be less than 1000 pairs (LCC 1987).

In its final recommendations, the Scientific Advisory Committee (1991) determined that the Malleefowl is:

- in a demonstrable state of decline that is likely to result in extinction; and
- significantly prone to future threats which are likely to result in extinction.

Major Conservation Objective

The major conservation objective is to increase the Malleefowl breeding population in Victoria to 2000 pairs over the next 20 years.

Management Issues

Ecological Issues Specific to the Taxon

Habitat quality for Malleefowl is severely reduced by fire (Tarr 1965, Cowley et al. 1969, Woinarski 1989, Benshemesh 1990, 1992a) and more effective fire control may be the single most important factor in improving the conservation status of the species. Conservation reserves should ideally be large enough to allow for large scale disturbance such as fire (Pickett &Thompson 1978), but the scale of fire in mallee landscapes is similar to the size of even the largest mallee reserves. For example, within the Big Desert landsystem, which is the major stronghold of Malleefowl in Victoria (Emison et al. 1987), extensive wildfires have occurred with a frequency of about once every 20 years (Cheal et al. 1979, Day 1982), the most severe of which burnt about 600,000 hectares (Cheal et al. 1979). In general, the LCC (1987) has estimated that over 60% of Victorian mallee has been burnt during the past 15 years. Similarly in New South Wales, mallee that has remained unburnt for more than 20 years is rare, the majority having been burnt in a series of wildfires that covered about 1.5 million hectares of this habitat type in the summer of 1974/5 (Noble et al. 1980, Noble 1984).

While the negative effects of fire on Malleefowl breeding densities are severe and long-lasting, other aspects of Malleefowl ecology may mitigate these effects, provided that fires are not extensive, and that long-unburnt patches of habitat frequently occur. Benshemesh (1990, 1992a) found that breeding Malleefowl confined to small unburnt patches in otherwise recently burnt mallee readily fed in the burnt areas, and their breeding success was similar to that before the fire. Moreover, newly hatched chicks dispersed widely (up to 5 or 10 km) through the burnt areas and were able to survive in these areas for several weeks at least. Thus, fires with a high edge-to-area ratio, such as fire-breaks, are likely to do less harm to Malleefowl populations than fires of the same size but with less edge. Mosaics of habitat at various ages might also provide a balance between habitat requirements of Malleefowl and protection from fire, and the attributes of such beneficial

mosaics should be investigated after the populations of the birds are mapped across the larger reserves.
Malleefowl densities are known to be severely reduced in areas grazed by sheep, and a similar effect is likely where other feral or native grazers are over-abundant. Frith (1962a) reported that habitats grazed by sheep supported only 9-16% the density of breeding pairs that were supported by ungrazed habitat, an effect probably due to competition for food supplies and because continual sheep grazing prevents the regeneration of many herbs and seed bearing shrubs. Licensed grazing on most public land in Victorian mallee is due to be phased out during the next decade (LCC 1989). However, the feral Goat is common in some mallee areas (Henzell & McLeod 1984, Newsome 1989), may be more damaging to shrub populations than sheep (Harrington 1979, 1986), and need to be controlled. Over-abundance of the Western Grey Kangaroo at some Victorian reserves (e.g. Hattah-Kulkyne National Park) may produce similar detrimental effects as sheep grazing. Rabbits are generally rare in mallee (Frith 1962a) except at the mallee edge, but might have a severe effect in small reserves with a high edge-to-size ratio.
Foxes have long been considered a serious threat to the conservation of Malleefowl, and are currently regarded as the major factor contributing to the decline of Malleefowl in New South Wales (Priddel 1989, 1990). High predation rates by Foxes on eggs has been recorded (Frith 1959, 1962a) although more recent studies have recorded negligible levels (Booth 1987, Brickhill 1987b, Benshemesh 1988, 1992a) suggesting that significant predation on eggs is uncommon. Foxes are known to take adult birds, but most studies have shown only low levels of predation on adults (Frith 1962a, Benshemesh 1988).
Chick mortality due to Foxes (and perhaps feral Cats Felis catus) can be high. In Victoria, about a third of deaths of radio-tracked chicks were due to Foxes (and possibly Cats) (Benshemesh 1988, 1992a), and similar studies in New South Wales have found that 40-60% of chicks were taken by Foxes (Priddel 1990). Both studies reported severe (about 80%) mortality during the first two weeks after release, and in neither study were any chicks known to survive more than a few months; other major causes of deaths being predation by raptors, and metabolic stress (probably starvation). Nevertheless, very high mortality (around 98%) is expected at some stage of the life cycle of Malleefowl as adults are long-lived in the wild and are likely to produce 100-200 young in their lifetime (Frith 1962a,b, Benshemesh 1992a).
Definite statements about the stability of populations in undisturbed habitat are difficult to make because of the paucity of long-term data on population levels at specific sites. Recent work suggests that Malleefowl populations are stable in the north-west of the state at sites that have not been burnt for several decades (Benshemesh 1989, 1992a). However, recent declines have been evident in smaller reserves at the edge of the species current distribution in Victoria (Gell 1985, Benshemesh 1989), and Fox predation may be a critical factor at these sites. In general, the effect of Fox predation on Malleefowl populations is probably related to the size of the habitat patch and the quality of that habitat for Malleefowl. Fox densities are considerably higher in areas close to agricultural land (Benshemesh 1992a) and are more likely to depress Malleefowl populations in marginal habitats where the species' hold may already be tenuous.
Whilst the status of the Malleefowl in Victoria is vulnerable, their ecology and distribution provide several advantages toward conservation of the species. These include their wide distribution both within the State where most suitable habitat is now reserved and can be managed appropriately, and interstate. Long-term stability of populations is facilitated by the high fecundity and longevity of adults, and restocking areas in which the species is declining is simplified by the readiness of the birds to breed in captivity, the lack of parental care of young, and the ease of rearing chicks.

Wider Conservation Issues

A reduction in the extent and frequency of fires in Malleefowl habitat is likely to benefit several species of wildlife whose future is insecure, and disadvantage none. Six other species of birds that inhabit Victoria mallee are considered endangered or vulnerable, and all prefer long-unburnt mallee (Meredith 1984, Emison et al. 1987, Garnett 1992a). Similarly, several species of threatened reptiles require long-unburnt mallee, while none requires frequent fire (Robertson et al. 1989). The control of feral mammals such as Goats, Rabbits and Foxes in Malleefowl habitats is likely to benefit both the flora and fauna of the mallee ecosystem. However, Rabbits and Foxes may need to be controlled in unison. This might be accomplished by poisoning Rabbits with 1080, thereby also poisoning Foxes that feed upon them (McIlroy & Gifford 1991). Fox predation on native fauna might temporarily increase if only Rabbits were reduced.

Social and Economic Issues

Most, if not all, significant populations of Malleefowl occur within conservation reserves. Hence implementation of this Action Statement should not disadvantage private landholders. A reduction in the frequency and extent of wildfire would benefit landholders.
Securing the species in Victoria would benefit tourism generally, and the burgeoning ecotourism industry in particular. The Malleefowl has wide popular appeal and is well known internationally for its remarkable nesting habits. Although Malleefowl are usually shy and elusive, many birds become conditioned to the presence of humans and may be quietly observed working their nesting mound on most days in spring and summer. Small groups of people at close quarters are often tolerated by the birds. The species is a major tourist attraction at Wyperfeld National Park, and for commercial tours operating in the Little Desert, Big Desert and Sunset Country regions.
The Malleefowl also provides a unique educational experience for schools, serving as an important illustration of principles in conservation, ecology and evolution. The Sea Lake High School has been visiting a site in Wathe Flora and Fauna Reserve for over 15 years, with Malleefowl being the focus of the excursions. Wyperfeld and Little Desert National Parks receive numerous visits from local and urban schools, as does the commercially operated Little Desert Lodge near Nhill, which is

specially equipped to provide information on Malleefowl biology.
Several community groups have recently formed to assist in the conservation of Malleefowl in Victoria. These include the Malleefowl Preservation Society based in Mildura, and the Friends of the Malleefowl in Nhill. Other natural history clubs have made important contributions to the conservation of Malleefowl, including the Mid-Murray Field Naturalists, the Bendigo Field Naturalists, and the Friends of Wyperfeld.

Management Action

Previous Management Action

- Several reserves created explicitly for the conservation of Malleefowl after lobbying by local natural history groups are: Wyperfeld National Park, Kiata Lowan Sanctuary, and Wathe, Wandown, and Wychitella Flora and Fauna Reserves.
- Frith (1956a,b, 1957, 1959, 1962a,b) undertook the first major research program on Malleefowl biology, publishing detailed accounts of the birds' breeding biology and conservation. In particular, Frith detailed the effect of grazing on Malleefowl densities, the distribution of the species in New South Wales, Fox predation on eggs and adults, and warned of the species imminent danger of extinction if clearing for agriculture continued and reserves were not created.
- In the early 1960s the Fisheries and Wildlife Division (Victoria) surveyed numerous sites for Malleefowl in north-western Victoria, which led to the acquisition of several reserves, including Wathe and Bronzewing Flora and Fauna Reserves.
- Angus Torpey and family surveyed a portion of Wathe reserve for Malleefowl nests in the early 1960s, and thereafter monitored this population for several years. These records suggest that Malleefowl numbers have not declined substantially over the past 30 years.
- In the early 1960s, the Bird Observers Club of Victoria conducted a search for Malleefowl nests in portions of Hattah National Park (Jones 1963), and several years later the Mid Murray Field Naturalists searched part of Wandown Flora and Fauna Reserve (Haywood 1970)
- Brickhill (1985, 1987a,b) examined the distribution, summer diet and breeding success of Malleefowl in New South Wales and developed methods for aerial surveys of nests. His findings confirmed that the species had declined alarmingly in that State, largely due to the extent of clearing but also due to other undetermined factors.
- Booth (1986, 1987) examined the ecology of Malleefowl in low rainfall mallee in South Australia. He provided data on home-range and breeding success and recorded unusually high predation of adult Malleefowl by Foxes.
- In 1983, the Victorian National Parks Service and National Estate (Victoria) funded a four-year study into the conservation ecology of Malleefowl in that state (Benshemesh 1988, 1990, 1992a). This study examined the cool season diet, ranging behaviour, breeding success, survivorship of chicks, habitat preferences and fire ecology of the species. Various volunteer groups made major contributions to this study, including the Friends of Wyperfeld and Operation Raleigh who established 12 monitoring sites in NW Victoria totalling over 30 km2.
- In 1984 a major research program on Malleefowl conservation was initiated in New South Wales (Priddel 1989, 1990, Priddel & Wheeler 1990). This work, still under way, has focused on the factors affecting the survivorship of chicks and has demonstrated heavy predation of chicks by Foxes.
- Since 1984, three to four Malleefowl have been kept in captivity at the Little Desert Lodge (Wimpy Reichelt, proprietor) near Nhill. The birds are exhibited to the public and information is provided on the biology and conservation of the species. The Little Desert Lodge also has facilities to incubate Malleefowl eggs, and these are used (under permit) to hatch eggs from abandoned nests, and from nests on isolated remnants where the survival of chicks is unlikely. The resultant chicks are released into suitable reserves.
- In 1988 a major captive breeding program for Malleefowl was established at the Taronga and Western Plains Zoos in collaboration with the NSW National Parks and Wildlife Service with the aim of providing birds for restocking reserves in NSW.
- Following the LCC (1989) final recommendations for the Mallee Region and their acceptance by the Government, most areas in which Malleefowl occur in Victoria were incorporated into conservation reserves.
- In 1989 DCE funded a three month project (Benshemesh 1989) to permanently mark the 12 monitoring sites originally searched by Operation Raleigh (Benshemesh 1988), install and thoroughly search three new grids, and prepare a selection of eight grids for subsequent monitoring.
- Two grids for ongoing monitoring of Malleefowl were established in South Australian mallee late in 1989 (Brandle 1991).
- In 1990 DCE funded a three-month study into the feasibility of thermal-sensing active Malleefowl nests using an airborne infrared scanner (Benshemesh 1991), and to facilitate ongoing monitoring of prepared grids by DCE staff. This study showed that nests opened by the birds were detectable from aircraft, that the technique was potentially an efficient method of surveying vast areas, and that such surveys would be economical. However, further data were clearly needed to assess the overall feasibility of the technique and for its calibration.
- During the 1990/91 season DCE initiated regular monitoring of breeding densities at seven of the grids established by Operation Raleigh. This has been undertaken annually since, and three new grids have been added to the program. Associated with this monitoring are trials on the effect of removing Foxes from selected grids.
- In 1991, DCE staff assisted by members of the Chicago Zoological Society, Malleefowl Preservation Society and

the Mildura Bird Observers Club established and searched a monitoring grid in the Murray-Sunset National Park (Sluiter 1991).

- A Fire Protection Plan for public land in the Mallee Region of Victoria was drafted in 1991 (Edgar 1991). Although not aimed specifically at Malleefowl conservation, it describes actions that would benefit Malleefowl in the long term.
- Late in 1991 DCE funded a six-month project to continue assessing the feasibility of thermal-sensing Malleefowl nests (Benshemesh 1992b), and to review the DCE monitoring effort. Although further trials of the thermal-sensing technique were not possible, ground-based data provided guidelines for when to conduct scans, and suggested that more than a third of active nests would be detected by a single scan in spring.
- In 1992 an important private block of habitat ('Menzies') that supports a high breeding density of Malleefowl was bought by DCE with the assistance of the Victorian Conservation Trust and the Mid-Murray Field Naturalist Club.
- The Mid-Murray Field Naturalist Club established a fund in 1992 to help in Malleefowl management and the acquisition of Malleefowl habitat on private land.
- Early in 1993 a Recovery Plan Research Phase for Malleefowl was drafted (Benshemesh 1993). This document described research that is urgently needed to conserve Malleefowl in southern Australia, and was funded by ANPWS.
- Late in 1993 a series of trials of the thermal-sensing technique for mapping Malleefowl nests was conducted in preparation for broad-scale surveys. Important information about the abundance of Malleefowl was also collected during the trials.
- Foxes at three Malleefowl populations were controlled by 1080 baiting in 1990. Two of these (covering about 10 km2) have received continuing control to the present time.
- In 1994 a monthly cyanide-based Fox control program was begun on a 6 km2 Malleefowl grid to determine the demographic characteristics of Foxes that visit Malleefowl mounds. This is running concurrently with a similarly timed 1080 program and freefeed (control) prgram elsewhere in the Mallee.
- A further five monitoring grids were installed in the Murray-Sunset National Park through 1993, with the aid of the Australian Trust for Conservation volunteers.
- A Mallefowl monitoring grid was established at Hattah-Kulkyne National Park in conjunction with the Malleefowl Preservation Society and Mildura Venturers, making a total of 15 established grids.

Intended Management Action

Monitoring

- Continue CNR's annual monitoring of the eight grids so far prepared.
- Extend the monitoring grid system to incorporate a representative sample of habitat types and landscape contexts in Victorian mallee sites surrounded by suitable habitat and cleared land where ecological pressures may differ). This will involve another 10-12 sites, at least half of which will be selected for annual monitoring and the remainder monitored every 3-5 years.
- Examine the habitat difference between sites at which Malleefowl populations have declined and those which have remained stable or increased.
- Coordinate and liaise between the various natural history groups involved in Malleefowl conservation to ensure that their efforts are directed at critical issues and complement the works undertaken by CNR.

Inventory

- Further refine existing thermal-sensing techniques for rapidly surveying Malleefowl breeding densities. In particular, data on the nest-opening behaviour of Malleefowl will be collected by CNR (Mildura) over the following three years, and further flights will be conducted to fully test and describe the technique.
- Describe and map the critical habitat of the Malleefowl within the larger blocks of mallee in Victoria, and prescribe appropriate management for these (such as fire control works). The thermal-sensing method will be used to survey breeding densities, and the data collected will be used to estimate the total population size for the state.
- In collaboration with ANCA and other state conservation agencies, extend the use of the remote sensing technique to include large blocks of Mallee outside Victoria.

Population Protection

- Continue 1080 control of Foxes on two Mallefowl grids.
- Continue cyanide poisoning of Foxes on one Mallefowl grid until 1996.

Research

- Continue and extend the trials on the effectiveness of Fox control on increasing Malleefowl abundance. No more than half the annually monitored sites will be subject to Fox control, the remaining serving as controls to the trials.
- Intensify Fox control if the ongoing research into the impact of Fox predation on Malleefowl in small reserves indicates the need.
- Examine the habitat preferences of Malleefowl, in particular the effects of timing, frequency and size of wildfires on the species (Garnett 1992b, Benshemesh 1993, Silveira 1993).
- Determine the longevity of breeding Malleefowl, and the rate of recruitment of young birds into the breeding population. This would necessitate a long-term study (10-20 years) of banded or otherwise permanently marked birds. These data are crucial for interpreting the stability of populations and the effects of introduced predators.
- Collect Malleefowl genetic material for the South Australian Museum which is examining the variation in the species across its range. This work will elucidate any major population units and disjunctions for the species

across its Australian range. It will assist with management of populations in key small reserves and with any possible reintroductions to areas where the species may be locally extinct or very rare.

General

- Implement the Fire Protection Plan for public land in NW Victoria, and refine this plan when critical Malleefowl habitats are identified and mapped.
- Continue to seek acquisition of small private land blocks with the aid of community groups such as the Mid-Murray Field naturalists and Victorian Conservation Trust.
- Foster the Land for Wildlife scheme with those landholders sympathetic to the concept of Malleefowl conservation.
- Continue to cooperate with individuals and community groups to protect Malleefowl and their habitat.
- Investigate the feasibility of organised community groups assisting with Fox control programs (shooting) in appropriate areas.

Other Desirable Management Actions

- Describe the degree to which habitat corridors are used by the birds, and the critical attributes of these that determine that use. Habitat corridors that facilitate dispersal of Malleefowl to neighbouring reserves may be of great benefit to their conservation and reduce the likelihood of local extinction.
- Restock with Malleefowl those reserves in which the species has severely declined or become extinct. This is especially desirable in central Victoria. However, the reasons for these declines should first be elucidated, and appropriate management implemented to improve the suitability of these reserves for Malleefowl.

Legislative Powers Operating

Legislation

Wildlife Act 1975 controls research, management and taking of protected wildlife.
National Parks Act 1975 provides for the reservation and management of natural areas.
Flora and Fauna Guarantee Act 1988 provides for the protection of flora and fauna in Victoria and the declaration of critical habitat.

Licence/Permit Conditions

A permit will not be given unless a proposal conforms with the broad conservation and research strategy proposed in this Action Statement and the ANPWS Recovery Plan.

Consultation and Community Participation

Natural history groups have played a major role in securing unreserved habitat (especially the Mid-Murray Field Naturalists) and assisting in surveys. CNR will continue to encourage this participation.

Implementation, Evaluation and Review

The Area Managers, North West and South West, are responsible for coordinating the implementation of this Action Statement. This document will be reviewed by the Flora and Fauna Branch five years after its publication.

Contacts

Management
CNR Flora and Fauna Guarantee Officers in Mildura, Horsham and Bendigo offices.
Flora and Fauna Branch, CNR.
National Parks Service, CNR.
Biology
J Benshemesh, CNR Mildura office.
Flora and Fauna Branch, CNR.

References

- Benshemesh, J. (1988) Report on a study of Malleefowl ecology. Unpublished report, CFL, Melbourne.
- Benshemesh, J.S. (1989) Report on the establishment of sites for the monitoring of Malleefowl populations: Operation Raleigh 1989. Unpublished report, CFL, Melbourne.
- Benshemesh, J. (1990) Management of Malleefowl with regard to fire. In J.C. Noble, P.J. Joss & G.K. Jones (eds) The mallee lands, a conservation perspective. CSIRO, Melbourne. pp.206-11
- Benshemesh, J.S. (1991) Evaluation of thermal sensing for locating Malleefowl nests. Unpublished report, Dept Conservation and Environment, Melbourne.
- Benshemesh, J.S. (1992a) The conservation ecology of Malleefowl, with particular regard to fire. PhD thesis, Monash University, Clayton.
- Benshemesh, J.S. (1992b) Further investigations into the feasibility of surveying Malleefowl populations using airborne scanners. Unpublished report, DCE, Melbourne.
- Benshemesh, J.S. (1993) Recovery Plan Research Phase for Malleefowl (draft). ANPWS, Canberra.
- Blakers, M., Davies, S.J.J.F. & Reilly, P.N. (1984) The Atlas of Australian Birds. RAOU and MUP, Melbourne.
- Booth, D.T. (1986) Crop and gizzard contents of two Malleefowl. Emu 86: 51-3.
- Booth, D.T. (1987) Home range and hatching success of Malleefowl, Leipoa ocellata Gould (Megapodiidae), in Murray mallee near Renmark, SA. Aust. Wildl. Res. 14: 95-104.
- Brandle, R. (1991) Malleefowl mound distribution and status in an area of the Murray Mallee of South Australia. Nature Conservation Society of South Australia, Adelaide.
- Brickhill, J. (1985) An aerial survey of nests of Malleefowl Leipoa ocellata Gould (Megapodiidae) in central New South Wales. Aust. Wildl. Res. 12:257-61.
- Brickhill, J. (1987a) Breeding success of Malleefowl Leipoa ocellata in central New South Wales. Emu 87: 42-5.
- Brickhill, J. (1987b) The conservation status of Malleefowl in New South Wales. MSc Thesis, University of New England, Armidale.
- Campbell, A.J. (1884) Malleehens and their egg mounds. Vict. Nat. 1:124-9.

- Campbell, A.J. (1901) Nests and eggs of Australian birds. The author, Melbourne.
- Cheal, P.D., Day, J.C. & Meredith, C.W. (1979) Fire in the National Parks of north west Victoria. National Parks Service, Melbourne.
- CNR (1993) Threatened wildlife in Victoria. CNR, Victoria.
- Cowley,R.D., Heislers, A. & Ealey, E.H.M. (1969) Effects of fire on wildlife. Proc. Fire Ecology Symposium, Monash University.
- Day, J. (1982) Fire history and fire records. In A. Heislers, P. Lynch & B. Walters (eds) Fire ecology in semi-arid lands. CSIRO, Deniliquin. pp. 1-6.
- DSE (2002) Atlas of Victorian Wildlife (Electronic Fauna Database). Parks, Flora & Fauna, Department of Sustainability & Environment, East Melbourne.
- Edgar, T. (1991) Mildura Region fire protection plan (draft). DCE, Mildura.
- Emison, W.B., Beardsell, C.M., Norman, F.I., Loyn, R.H. and Bennett, S.C. (1987) Atlas of Victorian Birds. CFL and RAOU, Melbourne.
- Frith, H.J. (1956a) Breeding habits of the family Megapodiidae. Ibis 98:620-40.
- Frith, H.J. (1956b) Temperature regulation in the nesting mounds of the Mallee-fowl, Leipoa ocellata Gould. CSIRO Wildl. Res. 1: 79-95.
- Frith, H.J. (1957) Experiments on the control of temperature in the mound of the mallee fowl, Leipoa ocellata Gould (Megapodiidae). CSIRO Wildl. Res. 2: 101-10.
- Frith, H.J. (1959) Breeding of the Mallee Fowl, Leipoa ocellata Gould (Megapodiidae). CSIRO Wildl. Res. 4: 31-60.
- Frith, H.J. (1962a) Conservation of the Mallee Fowl, Leipoa ocellata Gould (Megapodiidae). CSIRO Wildl. Res. 7: 33-49.
- Frith, H.J. (1962b) The Mallee Fowl. Angus & Robertson, Sydney.
- Garnett, S. (1992a) Threatened and extinct birds of Australia. RAOU Report No. 82, Melbourne.
- Garnett, S. (1992b) The Action Plan for Australian Birds. Endangered Species Program Project No. 121. ANPWS, Canberra.
- Gell, P.A. (1985) Birds of remnant mallee isolates at Wedderburn: a biogeographic approach to nature reserve delineation and management. Monash Publications in Geography No.31. Monash University, Melbourne.
- Harrington, G.N. (1979) The effects of feral goats and sheep on the shrub populations in semi-arid woodland. Aust. Rangel. J. 1: 334-45.
- Harrington, G.N. (1986) Herbivore diet in a semi-arid Eucalyptus populnea woodland. 2. Feral goats. Aust. J. Exp. Agric. 26: 423-29.
- Haywood, J.L. (1970) Report of a Malleefowl survey. Mid Murray Field Naturalist 3: 14-16.
- Henzell, R.P. & McLeod, P.I. (1984) Estimation of the density of feral goats in part of arid South Australia by means of the Petersen Estimate. Aust. Wildl. Res. 11: 93-102.
- Jones, J. (1963) Malleefowl mound count. Bird Observer 374: 3-4, 375: 5-7.
- Kimber, R.G. (1985) The history of the Malleefowl in central Australia. RAOU Newsletter 64: 6-8.
- Korn, T. (1989) The Malleefowl of the Goonoo Forest, Dubbo. National Parks Journal: pp.22-4.
- LCC (1987) Report on the Mallee Area review. Land Conservation Council, Melbourne.
- Mattingly, A.H.E. (1908) Thermometer bird or mallee fowl. Emu 8: 53-61, 114-21.
- Meredith, C.W. (1984) Fire and birds: the result of two studies and their relevance to fuel reduction burning. In E.H.M. Ealey, (ed.) Fighting Fire with Fire. Graduate School of Environmental Science, Monash Univ., Clayton. pp. 193-202.
- McIlroy, J.C. &Gifford, E.J. (1991) Effects on non-target animal populations of a rabbit trial-baiting campaign with 1080 poison. Aust. Wildl. Res. 18: 315-25.
- Newsome, A.E. (1989) Large vertebrate pests. In J.C. Noble & R.A. Bradstock (eds) Mediterranean landscapes in Australia: mallee ecosystems and their management. CSIRO, Melbourne. pp. 406-17
- Noble, J.C. (1984) Mallee. In G.N. Harrington, A.D. Wilson & M.D. Young (eds) Management of Australia's rangelands. CSIRO, Melbourne.
- Noble, J.C., Smith, A.W. and Leslie, H.W. (1980) Fire in the mallee shrublands of western New South Wales. Aust. Rangel J. 2: 104-14.
- Pickett, S.T.A. & Thompson, J.N. (1978) Patch dynamics and the design of nature reserves. Biol. Cons. 13: 27-37.
- Priddel, D. (1989) Conservation of rare fauna: the Regent Parrot and the Malleefowl. In J.C. Noble & R.A. Bradstock (eds) Mediterranean landscapes in Australia: mallee ecosystems and their management. CSIRO, Melbourne. pp. 243-9.
- Priddel, D. (1990) Conservation of the Malleefowl in New South Wales: and experimental management strategy. In J.C. Noble, P.J. Joss and G.K. Jones (eds) The mallee lands, a conservation perspective. CSIRO, Melbourne. pp. 71-7.
- Priddel, D. & Wheeler, R. (1990) Survival of Malleefowl chicks in the absence of ground-dwelling predators. Emu 90: 81-7
- Robertson, P., Bennet, A.F., Lumsden, L.F., Silveira, C.E., Johnson, P.G., Yen A.L., Milledge, G.A., Lillywhite, P.K. & Pribble, H.J. (1989) Fauna of the mallee study area north-western Victoria. ARI Technical Report Number 87, CFL, Melbourne.
- Saunders, D.A. and Curry, P.J. (1990) The impact of agricultural and pastoral industries on birds in the southern half of Western Australia: past, present and future. Proc. Ecol. Soc. Aust. 16: 303-21.
- Scientific Advisory Committee, Flora and Fauna Guarantee (1991) Final recommendation on a nomination for listing. Malleefowl Leipoa ocellata (Nomination No. 166) DCE.

Compiler
J.S. Benshemesh

Further information

Further information can be obtained from Department of Sustainability and Environment Customer Service Centre on 136 186.

Flora and Fauna Guarantee Action Statements are available from the Department of Sustainability and Environment website: http://www.dse.vic.gov.au

References (cont.)

- Silveira, C. (1993) The Recovery Plan for Australian Mallee Birds-addressing fire as a threatening process (Research Phase). Draft submitted to ANPWS in May 1993. Canberra.
- Sluiter, I. (1991) Report on the establishment of the Pheeny's Track Malleefowl monitoring grid Yanga-Nyawi (Murray-Sunset) National Park, 23-27 July 1991. Unpublished report, DCE, Mildura.
- Tarr, H.E. (1965) The Mallee-fowl in Wyperfeld National Park. Austr. Bird Watcher 2: 140-4.
- Weathers, W.W., Weathers, D.L. & Seymour, R.S. (1990) Polygyny and reproductive effort in Malleefowl Leipoa ocellata. Emu 90: 1-6.
- Woinarski, J.C.Z. (1989) Broombush harvesting in southeastern Australia. In J.C. Noble & R.A. Bradstock (eds) Mediterranean landscapes in Australia: mallee ecosystems and their management. CSIRO, Melbourne pp. 362-78.