Malleefowl (*Leipoa ocellata*) records in the Great Victoria Desert Western Australia

Report to the Great Victoria Desert Biodiversity Trust

Species and Communities Branch
Department of Parks and Wildlife

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Department of Parks and Wildlife

GREAT VICTORIA DESERT BIODIVERSITY TRUST

This report was prepared by the Department of Parks and Wildlife, Species and Communities Branch, for the Great Victoria Desert Biodiversity Trust.

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1. Introduction

1.1 Species Information

The malleefowl *Leipoa ocellata* is one of only three mound building bird species in Australia and the only one naturally occurring in Western Australia (WA). It is commonly known by the aboriginal name 'Nganamara' in the deserts of central Australia (J. Benshemesh 2006, pers. comm.) and as 'Gnow' or 'Lowan' in other regions. Historically they were found in semi-arid mallee, shrublands and woodlands across much of southern Australia but their range has greatly reduced, mostly attributed to extensive clearing for agriculture. In the WA wheatbelt, populations are now considered to be highly isolated and fragmented, and continue to be threatened by habitat clearing, competition for food with introduced herbivores, predation by foxes and cats, and increased frequency of wildfires and prescribed burning (Benshemesh, 2007) (Fig. 1).

The malleefowl is recognised as a threatened species and has been declared to be 'fauna which is likely to become extinct, or is rare, or otherwise in need of special protection' under the Western Australian *Wildlife Conservation Act 1950* and listed as Vulnerable on the *Wildlife Conservation (Specially Protected Fauna) Notice 2015.* Malleefowl is also listed as Vulnerable under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* and has been assigned the threat status of Vulnerable on the International Union for Conservation of Nature (IUCN) *Red List of Threatened Species*.

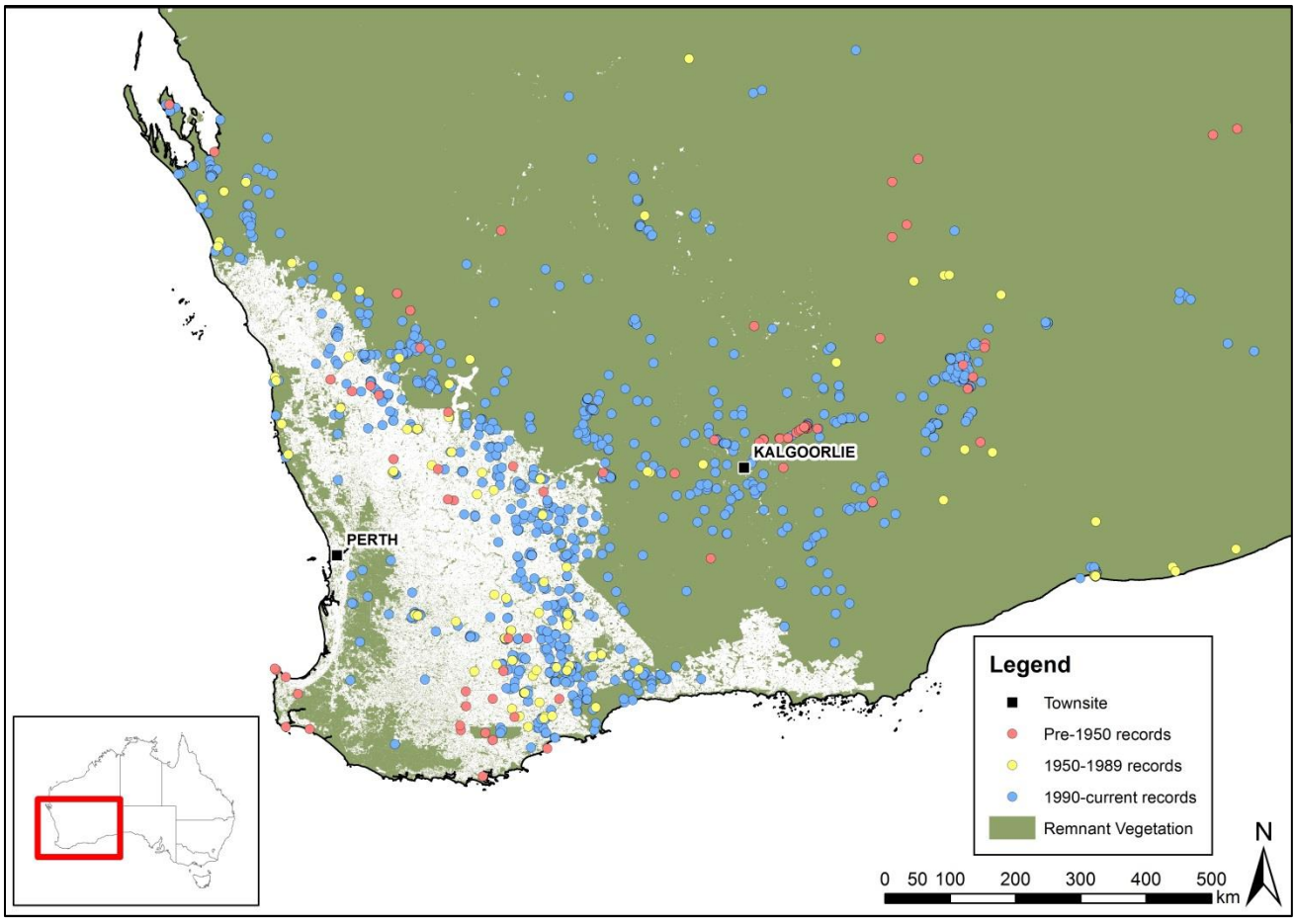


Figure 1: Malleefowl sightings in Western Australia (Department of Parks and Wildlife, 2016).

1.2 Project Outline

The Department of Parks and Wildlife collated malleefowl records in the Great Victoria Desert (GVD) as part of a project commissioned by the Great Victoria Desert Biodiversity Trust (GVDBT) (see Appendix 1 for project Expression of Interest). The aim of the project was to collect and collate all available presence data of malleefowl in the WA section of the GVD (the Study Area) to provide a foundation for understanding and investigating malleefowl distribution across the region. This has resulted in the creation of a database specifically for malleefowl records in the Study Area following an extensive literature review and collation of records from a variety of sources. In addition, a malleefowl-specific webpage has been created for inclusion under the threatened animals section of the Parks and Wildlife website and malleefowl-specific report forms have been developed for future sightings and additions to the database.

The purpose of this document is to summarise the work undertaken for this project.

1.3 Location

The GVD is the largest desert in Australia, stretching from east of Kalgoorlie in WA to west of Coober Pedy in South Australia (SA) (Fig. 2), with 52% of the bioregion falling within WA. The GVD bioregion is an arid environment, characterised by dunefields, and marble gum and mulga over spinifex grasslands. No major towns are situated within the GVD but there are a number of Aboriginal communities. The majority of the land tenure in the WA portion of the GVD is Unallocated Crown Land and Aboriginal Protected Areas, while the most western portion is mainly pastoral leases and includes mining tenements. Little is known about the ecology of the bioregion because the vastness and inaccessibility of the area has limited research.

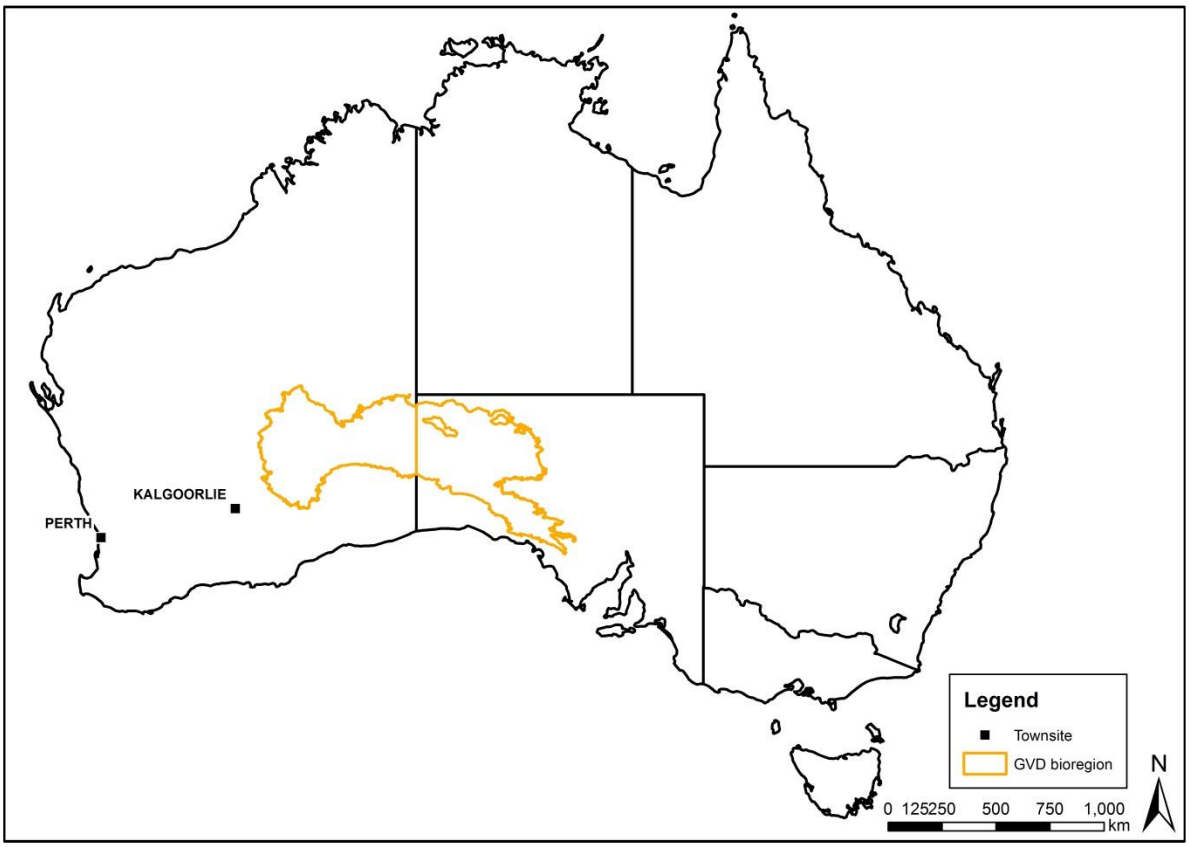


Figure 2: The Western Australian portion of the GVD bioregion (outlined in orange).

2. Methodology

The Department was tasked with creating a single database for all malleefowl records in the Study Area, with a broader aim of expanding it to include all malleefowl records in WA in the future. An extensive literature review was conducted of published, unpublished, historical and grey literature, and data was collated from a variety of sources including researchers, mining companies, environmental consultants, community groups and traditional owners. All data entered into the database was assessed for reliability and quality.

2.1 Database Design

The Malleefowl Database has been designed to capture the location and other details of malleefowl sightings. These sightings include both historical and modern records of the birds and secondary signs (e.g. mounds, eggs, diggings, scratchings, tracks, scats, feathers and bones). To date, records have been collated from the Department's Threatened Fauna Database and Fauna Survey Returns Database, and other relevant databases in NatureMap (including Bird Atlas, WA Museum and Atlas of Living Australia collections; see Appendix 3). The format of the database is based upon the Department's Threatened Fauna Database, but has been modified to exclude fields not relevant for this species and include additional fields required for this project. This will ensure that the database remains compatible with the Department's online public web portal for mapping species distribution, NatureMap, and other spatial projections such as the Great Victoria Desert Knowledge Hub by Gaia Resources and Rangelands NRM.

The broad categories of information included in the database are: Species, Database Details, Observer and Identification, Observation Date, Number of Individuals, Location Details, Coordinates, Habitat Description, Observation Details, Mound Measurements, Report Details, Attachments and Record Details (refer to Table 1 for the broad categories and details of the fields within each category).

Table 1: Broad categories and fields included in the Malleefowl Database

Broad Category	Field	Explanation
Species	Scientific Name	*Refer to Appendix 2, Table 7*
Database Details	Source	*Refer to Appendix 3, Table 8*
	Source ID	Number assigned to record in the source database
Observer and Identification	Observer	Observer's name (can be a generic company name)
	Certainty	*Refer to Table 4*
	Distinguishing Features	Description of identifiable features of individual or secondary signs.
	Confirmation of ID	Name of person who has confirmed the identification
	Specimen	*Refer to Appendix 4, Table 9*
	Specimen ID by	Name of expert who has confirmed the identity of the specimen
	Catalogue Number	Museum, Institution or Private Collection reference number
	Specimen Held	Museum, Institution or Private Collection where the specimen is kept
Observation Date	Day	Date and time of observation. If only a year is provided, the day and month are entered as the 1st of January. Time of observation is in 24hrs but does not need to
	Month	
	Year	

Broad Category	Field	Explanation
	Time	have a value.
Location Details	Locality Name	Name of suburb or postal boundaries
	Land Tenure	*Refer to Appendix 4, Table 10*
	Local Government Authority	Name of LGA
	District	Name of DPaW Administrative Region or District
	Site Details	Address or other site descriptor
Coordinates	Latitude	A set of coordinates must be provided for all records (i.e. Latitude and Longitude or Easting and Northing).
	Longitude	
	Easting	
	Northing	
	Map Zone	Map Zone must be defined if Northings and Eastings are provided (i.e. 49, 50, 51, or 52).
	Datum	Datum must be defined for all records (i.e. GDA94, WGS84, AGD66 or AGD84).
	Resolution (m)	*Refer to Table 5*
Habitat Description	Landform	*Refer to Appendix 4, Table 11*
	Vegetation Type	
	Vegetation Description	Further vegetation details, including other species present
	Fire History	May be text or numerical (years since last fire)
Observation Details	Method	*Refer to Appendix 4, Table 12*
	Observation Type	
	Total Individuals	
	Adult - Male	
	Adult- Female	
	Adult - Unknown	
	Juvenile - Male	
	Juvenile – Female	
	Juvenile - Unknown	
	Hatchling	
	Egg - unhatched	
	Egg shell	
	Mound - state unknown	
	Mound - active (at time of survey)	
	Mound - active (recently used)	
	Mound - inactive	
	Diggings/Scratchings	
	Tracks	
	Scats	
	Feathers	
	Bones	
	Observation Comments	
	Breeding Status	
Mound Measurements	Estimate age of mound (yr)	
	Diameter – ground level (m)	
	Height (m)	
	Rim Width (cm)	

Broad Category	Field	Explanation
	Crater Depth (cm)	
Report Details	Report Title	Name of report (record source)
	Report Comments	Further details about report, including where it was soured from and when (month and year)
	Author	Author of report
Attachments	Map	A Yes (Y) or No (B) must be entered in each column signifying whether the relevant document was attached to the report. All attachments are put on file and photos are electronically stored.
	Mud Map	
	Photo	
	Notes	
Record Details	Comments	Any additional comments about the record, usually entered by the reviewer.
	Checked Name	Initials of reviewer
	Checked Date	Date of review

The fields under Observation Details have been assigned a set of terms (i.e. no free text) so that data entry is standardised and specific to malleefowl characteristics. Refer to Appendix 4 for a glossary of these and other fixed term fields.

Currently, the Malleefowl Database captures records within the Study Area, but has the potential to be expanded to include all malleefowl records in the wider Goldfields region or the whole of WA.

2.2 Data Collation

All relevant databases (Appendix 3) were searched for malleefowl records, but only Threatened Fauna, Fauna Survey Returns and Bird Atlas 2 had records within the Study Area. Where possible, the original record sources were reviewed (e.g. report forms, published papers), to determine if more information was available than what was existing in the database record, to cross-reference the location and coordinates, and to determine if the identification could be confirmed to a higher degree of certainty. As an extra assessment of data quality, a column has been added to the database to note by whom and when the record was checked (i.e. by the Department's database officer).

Any records within a 10km buffer around the Study Area were included in the database. This buffer allows for any minor coordinate errors and takes into account the estimated home range of malleefowl (approximately 1-3km). However malleefowl in arid areas such as the GVD are verging on nomadic, having irregular or unpredictable home range, and an alternative estimated home range for the species within the Study Area is unknown (B. Parsons pers. comm.).

To ensure that all possible records were added to the database, a literature review was conducted of published, historical and grey literature, and relevant stakeholders were contacted for survey data and opportunistic sightings. New records will continue to be added to the malleefowl database as they are provided to the Department via database extraction, report forms or deduced from published or other reports.

2.2.1 Literature Review

A variety of literature was searched for records of malleefowl occurring in the GVD bioregion and surrounds that were not yet included in any database. This literature review included reference books, journal articles, survey reports, Environmental Impact Assessment reports, and recovery and management

plans. Previous names and spellings of malleefowl were used to search relevant historical accounts. Grey literature was searched to include any records in newsletters and magazines. This literature review also provided further details for some of the existing records that were missing information. Refer to Table 2 for a list of references.

Table 2: List of references reviewed for malleefowl sightings in GVD

	Reference	Records
Journal Articles	McKenzie, N. & A. Burbidge, A. 1979. The wildlife of some existing and proposed nature reserves in the Gibson, Little Sandy and Great Victoria Deserts, Western Australia. *Wildlife Research Bulletin Western Australia* 8:1-36.	One new record
	Booth, D. 1987. Home range and hatching success of malleefowl, *Leipoa ocellata* Gould (Megapodiidae), in Murray Mallee near Renmark, SA. *Australian Wildlife Research* 14(1):95-104.	No WA records
	Frith, H. 1961. Conservation of the mallee fowl, *Leipoa ocellata* Gould (Megapodiidae). *Wildlife Survey Section*. Canberra: CSIRO. 33-53	No WA records
	Bode, M. & Brennan, K. 2011. Using population viability analysis to guide research and conservation actions for Australia's threatened malleefowl *Leipoa ocellata*. *Oryx* 45(4):513-521	No records
	Parsons, B., Short, J. & Roberts, J. 2008. Contraction in the range of malleefowl (*Leipoa ocellata*) in Western Australia: a comparative assessment using presence-only and presence-absence datasets. *Emu* 108: 221-231.	No new records
	Ford, J. & Sedgwick, E. 1967. Bird distribution in the Nullarbor Plain and Great Victoria Desert region, Western Australia. *Emu* 67(2): 99-124.	One historical record
	Parsons, B. & Gosper, C. 2011. Contemporary fire regimes in a fragmented and an unfragmented landscape: implications for vegetation structure and persistence of the fire-sensitive malleefowl. *International Journal of Wildland Fire* 20: 184-194.	No GVD records
	Ford, J. 1987. Minor isolates and minor geographical barriers in avian speciation in Continental Australia. *Emu* 87(2): 90-102.	No records
	Short, J. & Parsons, B. 2008. Malleefowl Conservation - informed and integrated community action. A final report to WWF Australia and Avon Catchment Council. Perth: Wildlife Research and Management Pty Ltd.	No new records
	Thompson, S., Thompson, G., Sackmann, J., Spark, J. & Brown, T. 2015. Using high-definition aerial photography to search in 3D for malleefowl mounds is a cost-effective alternative to ground searches. *Pacific Conservation Biology* 21(30: 208-213.	No GVD records
	Brennan, K., Twigg, P., Watson, A., Pennington, A., Summer, J., Davis, R., Jackson, J., Brooks, B., Grant, F. & Underwood, R. 201). Cross-cultural systematic biological surveys in Australia's Western Desert. *Ecological Management and Restoration* 13(1):72-80	No new records, further details of existing records
	Cracraft, J. 1991. Patterns of diversification within continental biotas: hierarchical congruence among the areas of endemism of Australian Vertebrates. *Australian Systematic Botany* 4:211-27	No records
	Ford, J. 1970. Distribution and taxonomy of southern birds in the Great Victoria Desert. *Emu* 71:27-36	No records
Historical Accounts	Giles, E. 1889. *Australia Twice Traversed: The Romance of Exploratio, being a narrative compiled from the jounrals of five exploring expeditions into and through Central South Australia, and Western Australia, from 1872 to 1876.* (two volumes). London: Sampson Low, Marston, Searle & Rivington.	One new record
	Abbott, I. 2008. Historical perspectives of the ecology of some conspicuous vertebrate species in south-west Western Australia. *Conservation Science Western Australian* 6(3): 1-214	No new records
	Mattingley, A. 1908. Thermometer-Bird or Mallee-Fowl (Lipoa ocellata). *The Emu* 8(2): 52-61	No records
	Campbell, A. 1900. Campbell's own observations of the Mallee Fowl in Museum Victoria Collections. Http://collections.museumvictoria.com.au/articles/1386.	No GVD records
	Hawkeswood, T. 1993. The zoological observations made by Ernest Giles during two of his expeditions (1872-1874). *Sydney Basic Naturalist* 2:1-12	No new records, further details of existing records.

	Reference	Records
	Lindsay, D. 1893. *Journal of the Elder Exploring Expedition, 1891*." Adelaide, SA: s.n. p. 61-73.	Two new records
Survey Reports	Turpin, J. 2014. "Murrin Murrin - Sunrise Dam Infrasturcture Corridor Level 1 Fauna Survey." Prepared by Kingfisher Environmental Consulting for Anglogold Ashanti Australia.	One new record
	Turpin, J. 2015. "Sandhill Dunnart Monitoring: April and July 2015 Summary Report." Prepared by Kingfisher Environmental Consulting for Anglogold Ashanti Australia.	Five new records
	Turpin, J. 2014. "Sunrise Dam - Tropicana Infrastructure Corridor Fauna Survey." Prepared by Kingfisher Environmental Consulting for Anglogold Ashanti Australia.	No new records, further details of existing records.
	Turpin, J. 2014. "Sunrise Dam - Tropicana Infrastructure Corridor Preliminary Fauna Management Measures." Prepared by Kingfisher Environmental Consulting for Anglogold Ashanti Australia.	No records
	Outback Ecology (MWH). 2014. “Cyclone Mineral Sand Project: Terrestrial Fauna Impact Assessment”. Prepared for Lost Sands Pty Ltd.	No new records, further details of existing records.
	Barnett, B., Turpin, J. & Cancilla, D. 2009. "Tropicana Gold Project: Operational Area Vertebrate Fauna Assessment." Prepared by Ecologia Environment for Tropicana Joint Venture (AGAA and Inderpence Group NL)	Three new records
	Gaikhorst, G. & Lambert, C. 2009. "Tropicana Gold Project: Sandhill Dunnart Survey of the Proposed Operational Area and Infrastructure Corridors (Pinjin and Bypass) September 2009." Prepared for Tropicana Joint Venture (AGAA and Independence Group NL)	Two new records
	Gaikhorst, G. & Lambert, C. 2001. "Fauna Trapping Survey: Great Victoria Desert September-October 2000 March-April 2001." June 2001 Report prepared for CALM.	No records
	Gaikhorst, G. & Lambert, C. 2002. "Fauna Trapping Survey: Great Victoria Desert October 2001." June 2002 Report prepared for CALM.	No records
	Gaikhorst, G. & Lambert, C. 2006. "Fauna Trapping Survey: Great Victoria Desert March and October 2005." March 2006 Report prepared for CALM.	No records
	Gaikhorst, G. & Lambert, C. 2003. "Fauna Trapping Survey: Great Victoria Desert March 2003." August 2003 Report prepared for CALM.	No records
	Gaikhorst, G. & Lambert, C. 2008. "Fauna Trapping Survey: Great Victoria Desert April 2007." January 2008 Report prepared for CALM.	No records
	Gaikhorst, G. & Lambert, C. 2007. "Fauna Trapping Survey: Great Victoria Desert April 2006." March 2007 Report prepared for CALM.	No records
	Gaikhorst, G. & Lambert, C. 2003. "Fauna Trapping Survey: Great Victoria Desert October 2003." August 2004 Report prepared for CALM.	No records
	Heidrich, A. 2009. “Neale Junction Nature Reserve Vertebrate Fauna Survey.” Prepared by Ecologia for AngloGold Ashanti Australia.	No records
	Martinick, W. 1986. "Mulga Rock Flora, Fauna and Radioecology Survey." Jan 1986 Report Prepared by Martinick & Associates for PNC Exploration (Australia) Pty Ltd.	No records
	Barnett, B. & Menz, M. 2005. "Plumridge Lakes Exploration: Rare Flora and Fauna Survey April 2005." Prepared by Ecologia Environment for Western Areas NL.	No records
	Ninox Wildlife Consulting. 2009. "A Level One Survey of the Vertebrate Fauna. Infrastructure Corridor - Pinjin Option. L31/57, L39/185, Pinjin - Tropicana Gold Project." Prepared by Ninox Wildlife Consulting for Tropicana Joint Venture (AGAA and IGNL)	One new record, further details of existing records
	URS. 2009. "Final Report: Tropicana Gold Project Marsupial Mole Survey: Proposed Infrastructure Corridor - Pinjin Option." Prepared by URS for Tropicana Joint Venture (AGAA and IGNL).	No new records, further details of existing records.
	URS. 2009. "Final Report: Tropicana Gold Project Malleefowl and Mulgara Survey Operational Area." Prepared by URS for Tropicana Joint Venture	New records (require coordinates)
EIA reports	Vimy Resources Ltd. 2015. "Mulga Rock Uranium Project - Public Environmental Review."	New records (require coordinates)
	EPA WA. 2010. "Tropicana Gold Project Report 1361: report and recommendations of the Environmental Protection Authority."	No new records
	360 Environmental. 2010. "Tropicana Gold Project Public Environmental Review: Response	No records

	Reference	Records
	to Submissions and Supplementary Surveys."	
Management and Recovery Plans	APA Group. 2015. "Infrastructure Development: Eastern Goldfield Pipeline Threatened Species Management Plan." Prepared for AGAA mining infrastructure development.	No records
	Noble, K. 2002. "Plan of Management for the Ngaanyatjarra Lands Indigenous Protected Area." Prepared by People & Ecology on behalf of the Ngaanyatjarra Land Management Unit.	No records
	Barton, B. & Cowan, M. 2001. "Great Victoria Desert 3 (*GVD3 - Great Victoria Desert Eastern subregion*)." Perth, WA: Department of Conservation and Land Management. 358-362	No records
	Barton, B. & Cowan, M. 2001. "Great Victoria Desert 1 (*GVD1 - Great Victoria Desert Shield subregion*)." Perth, WA: Department of Conservation and Land Management. 343-350	No records
	Barton, B. & Cowan, M. 2001. "Great Victoria Desert 2 (*GVD2 - Great Victoria Desert Central subregion*)." Perth, WA: Department of Conservation and Land Management. 351-357	No records
	Desert Discovery Inc. 2010. "Sykes Bluff Project."	No records
	Desert Discovery Inc. 1998. "The Warri Project."	No records
	Benshemesh, J. 2007. National Recovery Plan for Malleefowl. Department of Environment and Heritage, South Australia.	No new records
Referenc e Books	Garnett, S., Szabo, J. & Dutson, G. 2011. The action plan for Australian birds 2010. Collingwood, Victoria: CSIRO.	No records
	Johnstone, S. & Storr, G. 1998. Handbook of Western Australian Birds: Volume 1 – Non-passerines (emu to dollarbird). Perth, WA: Western Australian Museum	No records
Newsletters and Magazines	Friends of the Great Victoria Desert Newsletter No 30-46 (April 2007-December 2015)	Possible records
	Newsletter of the national malleefowl recovery tea, Autumn 2013	No GVD records
	Brennan, K., Ford, S., Woolley, P., Barrett, S., Waldock, J. & Hitchcock, B.2009. Desert Diversity. *Landscope* :34-39	No records
	Eastwood, K. 2004. Lake Plumridge: rarely visited, this nature reserve in the Great Victoria Desert, Western Australia, is full of colour and life. *Australian Geographic* 2004(Jan-Mar):36-51	No records
	Hooper, K. & Pearson, D. 1996. Desert Spring: Exceptional Season in the Great Victoria Desert. *Landscope* 11(3):24-27	No GVD records
	Pearson, D. & Chapman, A. 1996. Wildlife and Flora of the Great Victoria Desert. *Landscope* Expeditions Report No. 13.	No GVD records

2.2.3 Stakeholder Data

Relevant stakeholders were contacted to request any unreported records and further information of existing records in the Study Area and surrounds. Non-government and not-for-profit organisations, mining and exploration companies, government departments, researchers and environmental consultants who have held licences for surveys in the GVD bioregion were contacted (Table 3).

Malleefowl Report Forms (complex and simple versions) were developed as part of this process and provided to all stakeholders that were contacted (refer to Appendix 5). These forms will help with collecting relevant details of malleefowl sightings, and will also encourage future reports of malleefowl both in the GVD and WA as a whole. BirdLife Australia was asked to publish a notice requesting malleefowl sightings in their e-news and quarterly magazine.

Table 3: List of stakeholders contacted for malleefowl sightings

Name	Organisation	Contacted	Data Provided
Alexandra Dent	AngloGold Ashanti Australia	Yes	Provided AGAA database and other survey details
Bill Dowling	Friends of Great Victoria Desert Parks, SA	Yes	Did not provide data, will provide any future opportunistic sightings
Blair Parsons	Greening Australia	Yes	No further data
Chris Curnow	Rangelands Australia	Yes	Provided data as part of coordinating approach and liaising with Traditional Owners
Clive Crouch	Consultant	Emailed	No response as yet
Colin Woolard	Woolard Consulting	Yes	Provided targeted survey report – no data
David Pearson	Department of Parks and Wildlife	Yes	Will provide historical and survey records, and possibly Traditional Owner records (pending TO approval)
David Robinson	Department of Agriculture and Food	Emailed	No response as yet
Glen Gaikhorst	GHD	Yes	Provided survey data
Jan Henry	Ninox Wildlife Consultancy	Yes	No data
Jeff Turpin	Consultant	Yes	Provided further information for survey data
Jennifer Jackson	Department of Parks and Wildlife	Yes	Coordination of TO approach, provided regional records
Joe Benshemesh	Consultant / La Trobe University	Emailed	No response as yet
John De Jose	Nest Egg Foundation (formerly Malleefowl Preservation Group)	Yes	Provided database and paper records.
John Dell	Retired OEPA	Emailed	No response as yet
Karl Brennan	Department of Parks and Wildlife	Yes	No further data
Kevin Coate	Retired naturalist	Yes	No further data
Mark Cowan	Department of Parks and Wildlife	Yes	No further data, provided other possible contacts
Michael Scanlon	Bennelongia Environmental Consultancy	Yes	No data, will provide future opportunistic sightings
Michael Young	Outback Ecology (MWH Global)	Emailed	No response as yet
Mike Bamford	Bamford Consulting, BirdLife Australia	Yes	Publishing note in BirdLife e-news as well as the quarterly magazine, contacting national officer for further sighting details
Mitchell Ladyman	Animal Plant Mineral Pty Ltd	Emailed	No response as yet
Ron Johnstone	WA Museum	Yes	Provided data
Roy Teale	Biota	Yes	No data
Tim Burnard	National Malleefowl Recovery Team	Yes	Provided WA data from the National Malleefowl Monitoring Database
Vi Saffer	Prev. Keith Lindbeck & Associates; Umwelt	Yes	No longer works at Umwelt; Umwelt will provide records subject to internal approval.
Vicky Bilney (via Tim Burnard)	Yongernow	Yes (via Tim)	Provided state-wide opportunistic sightings
William Low	Low Ecological Services	Emailed	No response as yet

2.3 Reliability and Quality of Data

The reliability and quality of the malleefowl records extracted from the relevant databases and provided by stakeholders was considered to be relatively accurate, due to the distinctiveness of the species, qualified observers, recent dates of observation, and GPS-based spatial details of the majority of the records. However, to ensure that all current and future records added to the database are reliable, there needs to be clear criteria to assess the quality of the data. These criteria fall into two categories explained in detail below: *Certainty of Species Identification* and *Accuracy of Spatial Coordinates*.

2.3.1 Certainty of Species Identification

A major component of assessing the reliability of the data was determining the certainty of species identification. The certainty has been determined for each record based on several criteria, including whether a specimen has been vouchered, whether photos have been provided or features have been described for confirmed identification, and whether the identifier is considered qualified/experienced. The certainty of species identification was been split into five levels based on these considerations, as outlined in Table 4.

Table 4: Certainty of species identification

Level of Certainty	Description
Very certain	Specimen is WAM vouchered, identifier is an expert and/or photos have been provided; OR identifier is not qualified (i.e. member of the public) but has provided a photo that has been reviewed by a qualified person
Certain	Identifiers are qualified, a conclusive description is provided and/or secondary signs are distinctive; OR Identifier is not qualified but has provided a conclusive description that has been reviewed by a qualified person
Moderately certain	Identifiers are qualified but secondary signs are only suggestive evidence
Not sure	Identifier not qualified and no description or photos have been provided
Not defined	Certainty is unknown due to a lack of data

Malleefowl and their secondary signs (in particular, malleefowl mounds) are highly distinctive and so it is unlikely that records are misidentifications. The only other birds similar in size and colouring with overlapping distribution are the Australian bustard *Ardeotis australis* and the bush stone-curlew *Burhinus grallarius*. They may be mistaken for malleefowl if the bird was moving quickly through bush. However, the proportional sizes of the birds are quite different, with the leg and neck length of malleefowl being considerably shorter. These details are requested to confirm identification when observers have little knowledge of malleefowl. Malleefowl are the only mound builders in WA, and active mounds are evident features in the landscape due to their size and shape. Sightings of mounds have been rated as certain, or very certain if confirmed by an expert or through providing a photo, except for very old mounds (inactive for >30 years) which would have eroded considerably. Malleefowl eggs and feathers are also distinctive enough to be rated as certain if identified by a suitably qualified observer. When a record is identified based on less conclusive evidence (scratching, tracks, feathers, egg remnants) the certainty is considered moderate unless confirmed by an expert.

The majority of the records are from Level 1 or Level 2 environmental surveys undertaken for scientific purposes by trained scientists, so it can be assumed that these observers are suitably qualified to identify birds, mounds and other secondary signs. Records based on tracks are rated as certain only when they have been identified by an expert and specific survey techniques (sand pads) were used to target malleefowl tracks.

2.3.2 Accuracy of Spatial Coordinates

The reliability and quality of the data is also in part dependent on the accuracy of spatial coordinates. In the database, the level of accuracy is based on the resolution of the coordinates. Resolution, measured in metres, is the precision with which the coordinates represent the sighting location. Recent records, unless otherwise stated by the observer, are set a resolution of 1km. Table 5 outlines the level of accuracy of the set resolution distances used in the Malleefowl Database based on the existing classifications used in the Department's Threatened Fauna Database.

Table 5: Accuracy of spatial coordinates

Resolution (m)	Level of Accuracy
5m	Accuracy decreases as distance increases. For example, a resolution of ≤50m indicates that the location of the sighting can be identified within ≤50m metres of the coordinate location provided. This is a highly accurate record. Conversely, a resolution of 10,000m indicates that the location of sighting could be anywhere within 10km of the coordinate location. This is a less accurate record.
10m	
20m	
50m	
100m	
500m	
1,000m (1km)	
10,000m (10km)	
50,000m (50km)	
100,000m (100km)	

The accuracy of a set of coordinates is based on the coordinate source (e.g. GPS, map, GIS), the age of the record, and whether adequate location details have been provided. The majority of the records are recent and have coordinates sourced from a GPS, and therefore the level of accuracy is high (resolution ≤ 50 m). These coordinates have been reviewed by cross-referencing the site details within the coordinates in a GIS mapping program. The coordinates for the historical records are considered to have a low accuracy, as they have been located using a GIS mapping program based on site descriptions. The site descriptions for these records may not be very specific, and so only provide a general locality of the sighting. Such records are assigned a resolution of ≥ 10 km.

It should be noted that coordinates, no matter what the resolution has been set as, will have an inherent degree of error due to mapping and GPS inconsistencies.

3. Results and Discussion

3.1 Database Limitations

There has been a distinct lack of species-targeted surveys for malleefowl in the GVD, and opportunistic sightings are limited to the few areas with built infrastructure (e.g. major roads). A large proportion of the data was provided by or on behalf of AngloGold Ashanti Australia who have been required to conduct species-targeted surveys and malleefowl monitoring within their mining tenements as part of their lease/licence agreements. As such records are strongly biased to these areas.

In its current state the database only records presence data (not absence) and has a limited number of records (206). As such the database likely reflects survey effort rather than distribution and thus conclusions regarding trends or patterns in malleefowl distribution in the GVD cannot be reliable drawn from this database at present.

These limitations should be considered in relation to the following presentation of results.

3.2 Current State of Database

3.2.1 Data Collation Statistics

To date, 206 malleefowl sightings in the GVD have been entered into the Malleefowl Database (Fig. 3 and Fig. 4). The majority of the records were extracted from existing databases available through NatureMap, but a further 76 records were added to the database from the literature review or provided by stakeholders during the project. The records span the years of 1873 to 2015 comprising:

- nine historical records (pre-1950),
- seven pre-modern records between the period of 1950-1989, and
- 190 records from modern times (1990-current).

3.2.2 Data Quality

The majority of the records were provided by observers with high levels of expertise, and have recent dates of observation and GPS-based spatial details. Therefore, the reliability and quality of the records are considered to be relatively accurate:

- two records have not been given a level of certainty as they currently lack adequate details,
- 22 records are considered to be moderately certain,
- 114 records are considered to be certain and,
- 68 records are considered to be very certain.

This is further demonstrated by the methods of observation:

- two records with unknown methods of observation,
- 27 opportunistic records, which includes sightings by experts and environmental consultants and,
- 177 records observed during Level 1, Level 2 and Targeted surveys.

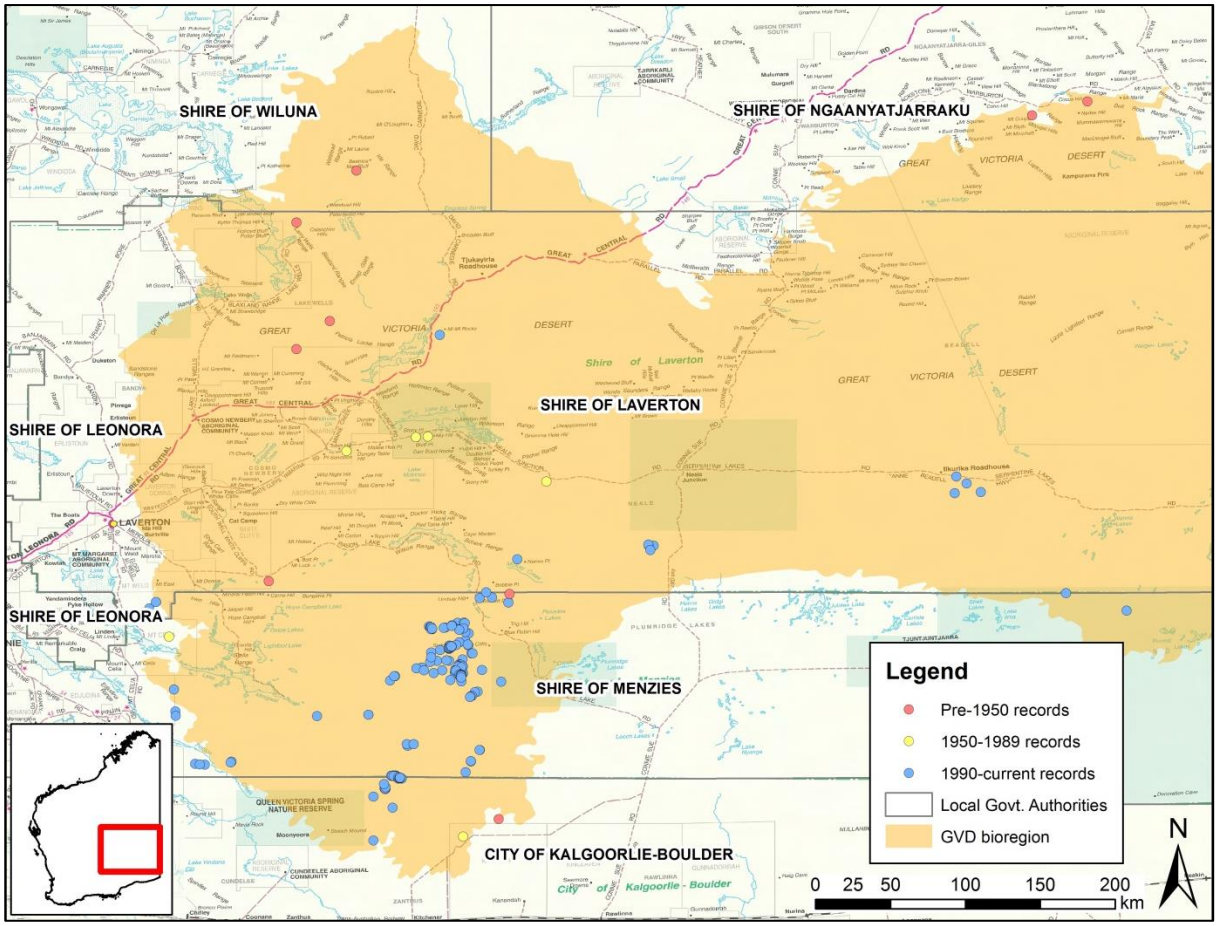


Figure 3: Malleefowl sightings in the GVD bioregion over time and area with Local Government Authority boundaries.

3.3 Patterns and Trends

3.3.1 Land Tenure

Of the modern records, the majority are located on unallocated Crown land (Figs. 4a and 4b) which are covered by mining or exploration leases:

- six are located on or near pastoral leases (Fig. 5);
- three are on or near nature reserves (Fig. 6);
- 10 are on or near indigenous lands (including Indigenous Protected Areas, DAA Aboriginal Land and Native Title) (Figs. 7a and 7b); and,
- 182 records are located on or near mining tenements (live and pending), most of which are held by AngloGold Ashanti Australia Ltd. in the south-west portion of the GVD (Fig. 8a and 8b).

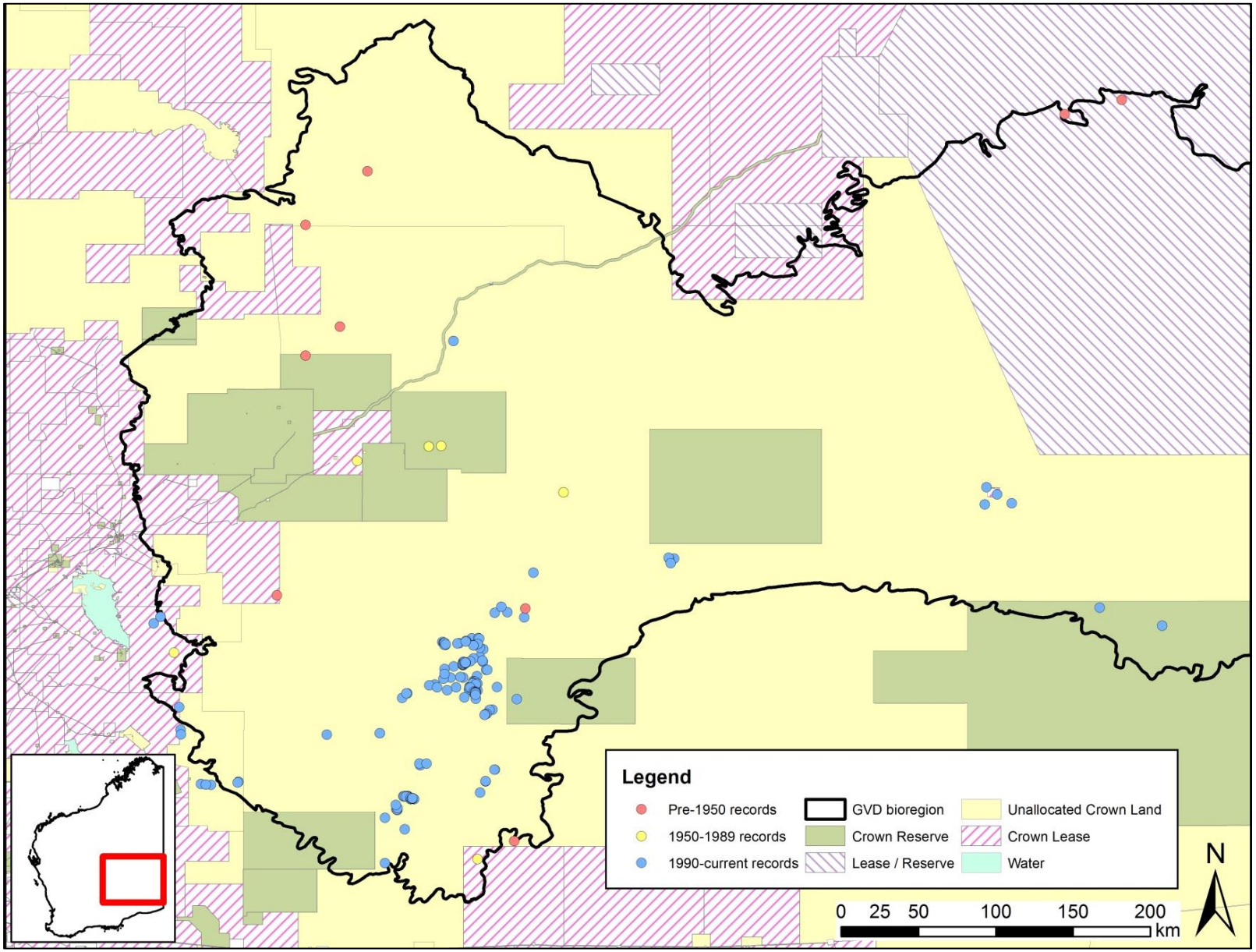


Figure 4a: Malleefowl records on all land tenures.

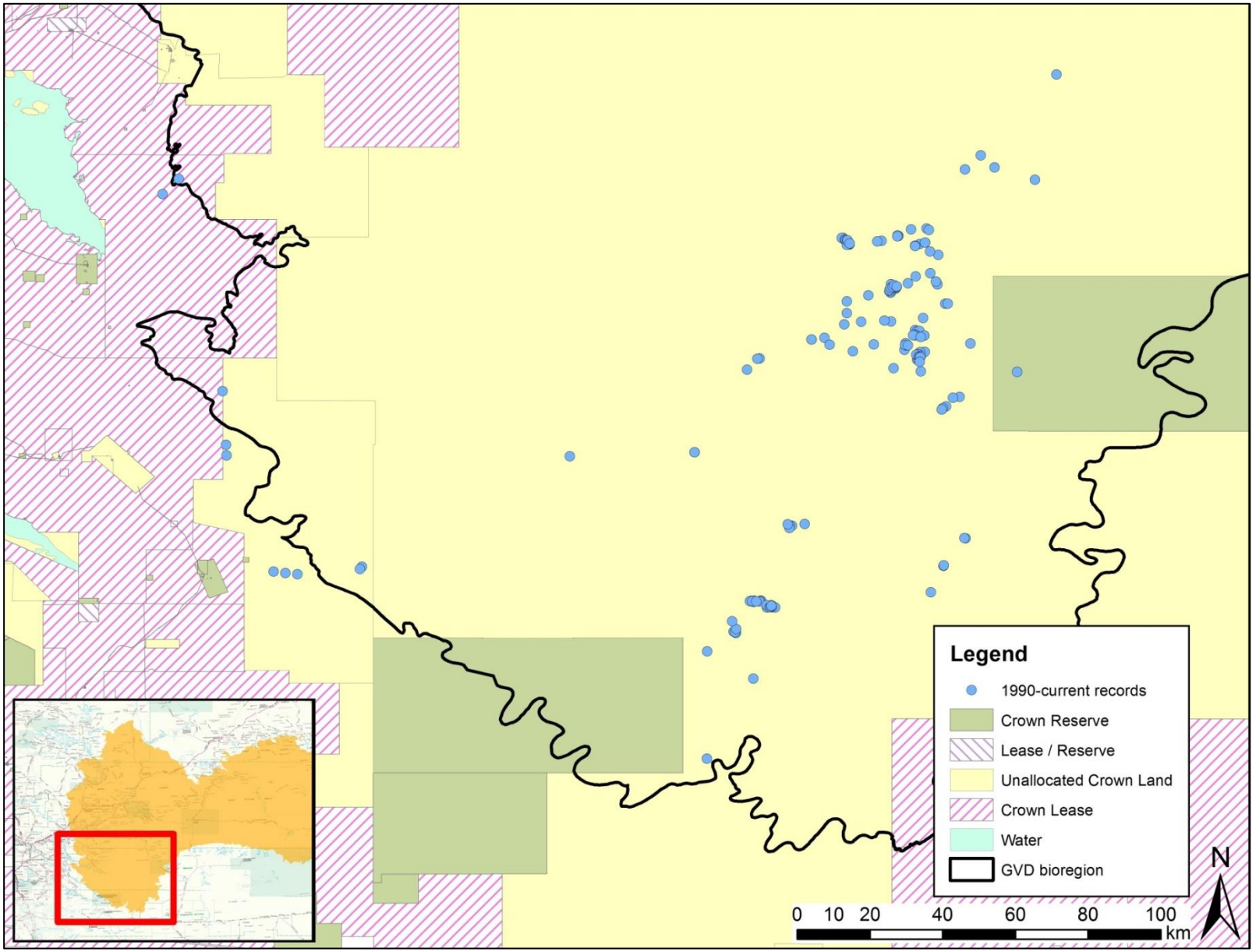


Figure 4b: Inset of majority of recent records (post-1990) on land tenures in the south-west portion of the GVD.

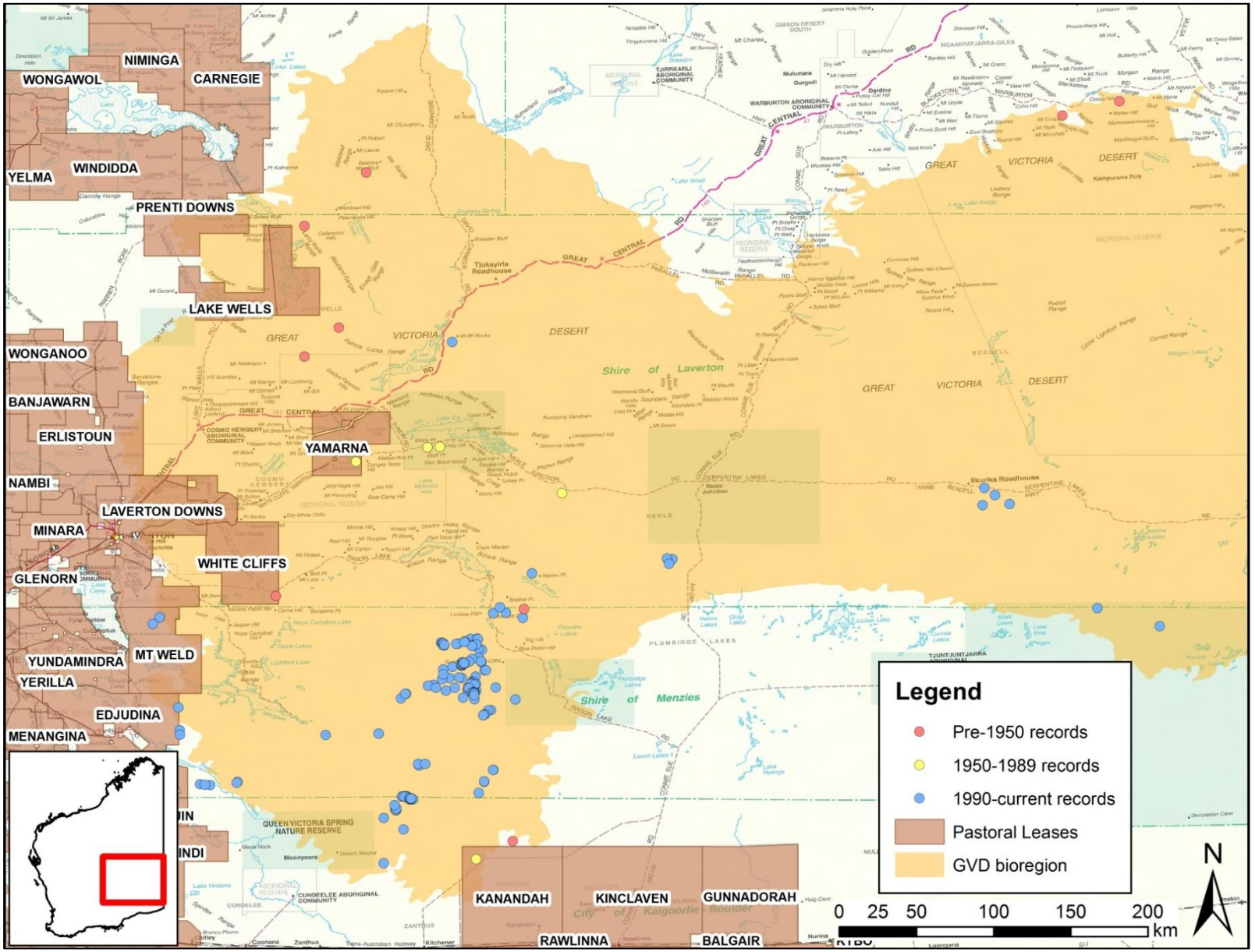


Figure 5: Malleefowl records on pastoral land.

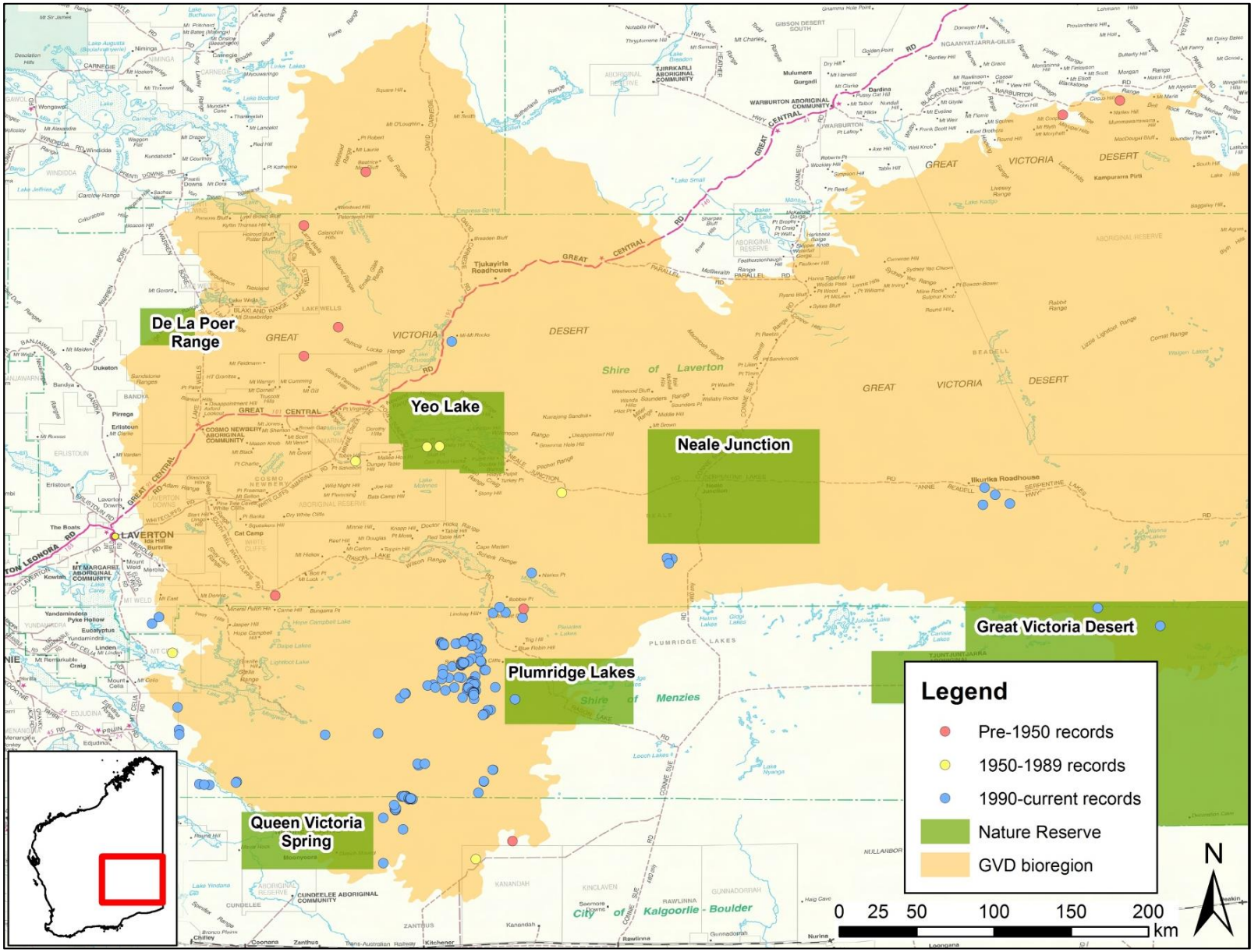


Figure 6: Malleefowl records on Conservation Estate.

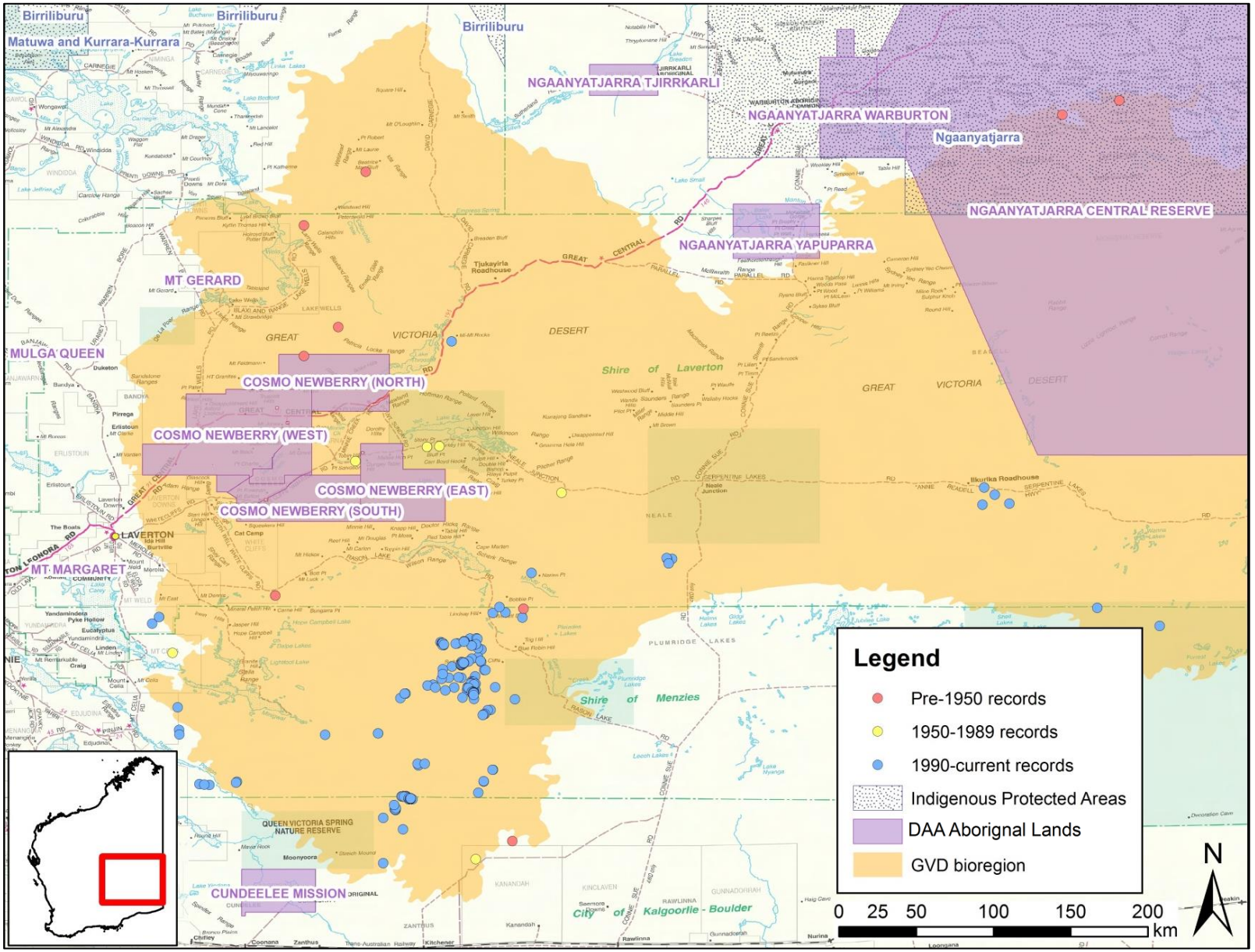


Figure 7a: Malleefowl records on Department of Aboriginal Affairs (DAA) Aboriginal lands and Indigenous Protected Areas.

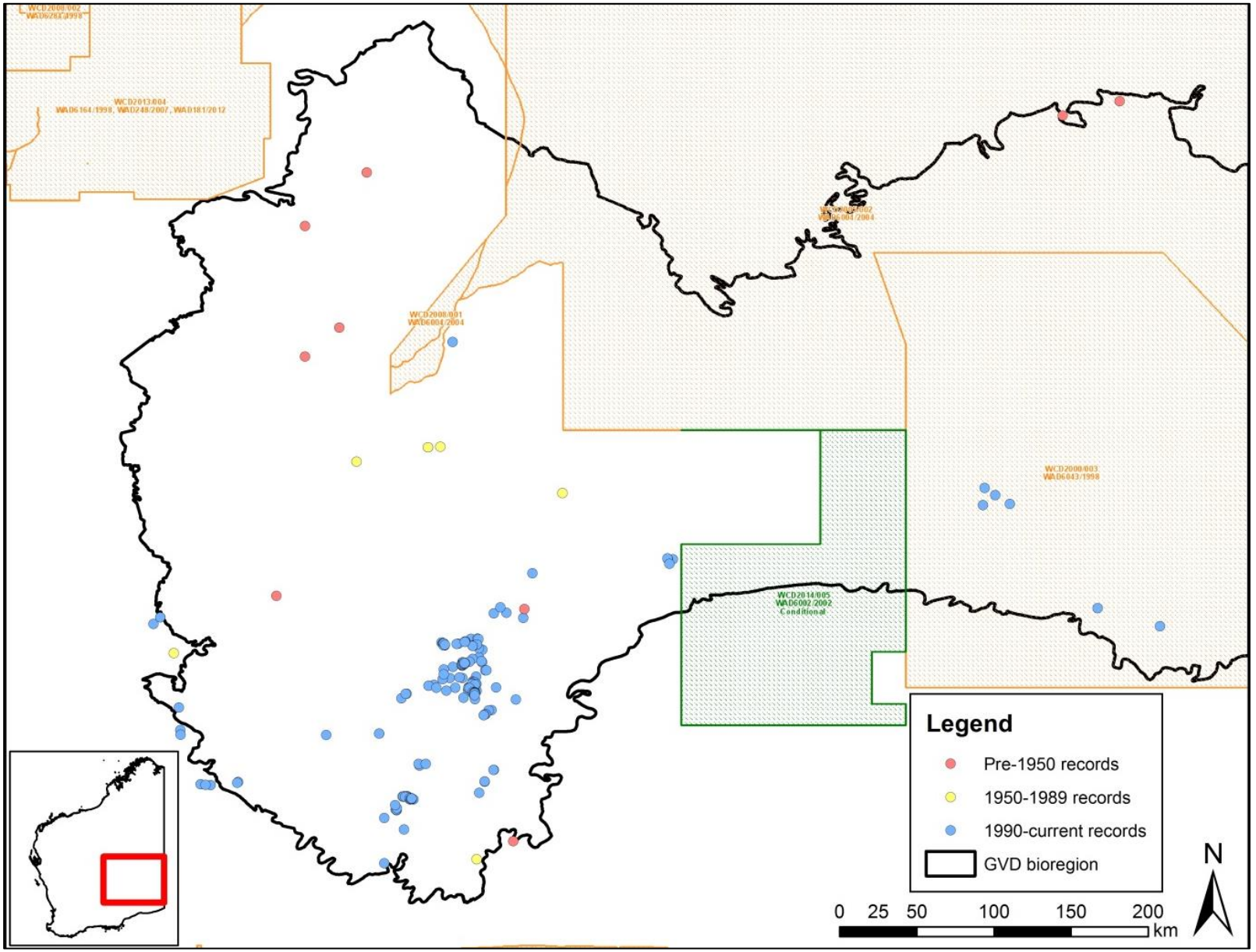


Figure 7b: Malleefowl records on Native Title lands.

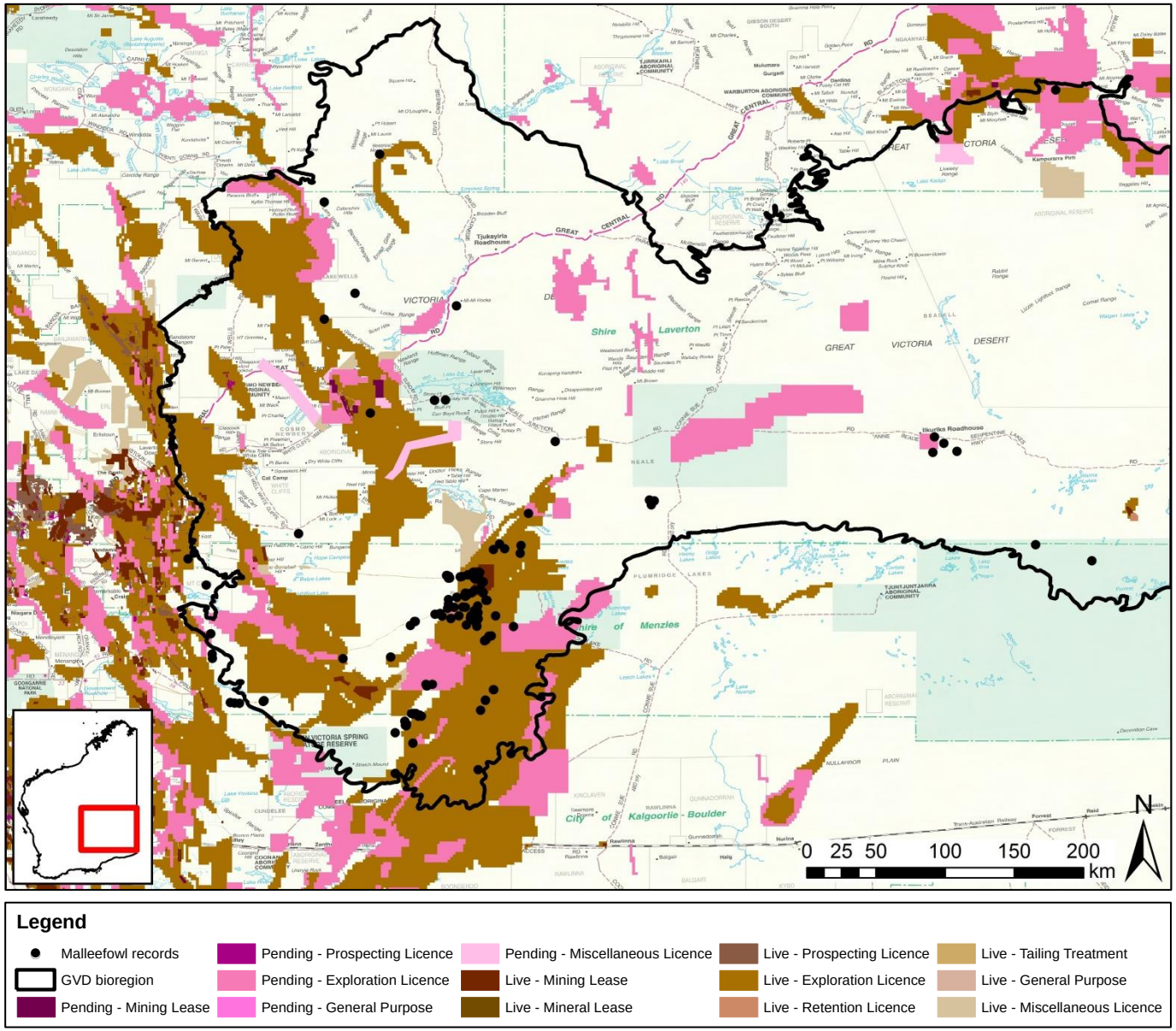


Figure 8a: Malleefowl records on live and pending mining tenements.

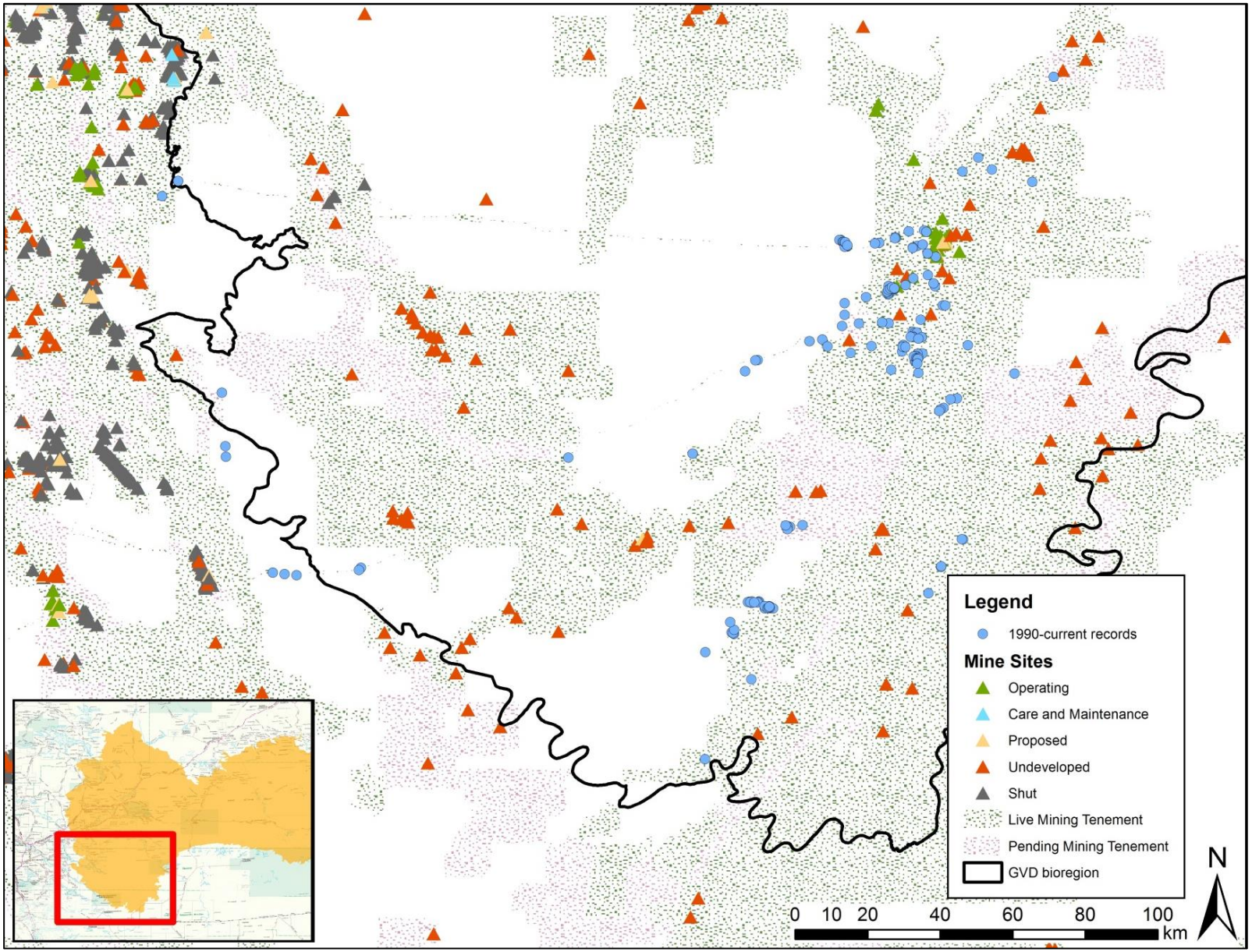


Figure 8b: Inset of majority of recent records (post-1990) located on mining tenements.

3.3.2 Habitat Type

Based on physiognomic vegetation mapping, the Study Area is characterised by tree and shrub-steppe spinifex grasslands (Fig. 9a). However, the majority of the records are located in low Mulga woodland (Fig. 9b). This may be due to a preference by malleefowl to utilise areas with abundant leaf litter, like that available in Mulga woodlands, to build mounds.

The vegetation layer is based on Beard, J. S., Beeston, G. R., Harvey, J. M. Hopkins, A. J. M. & Shepherd, D.P. 2013. The vegetation of Western Australia at the 1:3 000 000 scale: Explanatory memoir (2nd Ed.). *Conservation Science Western Australia* 9.

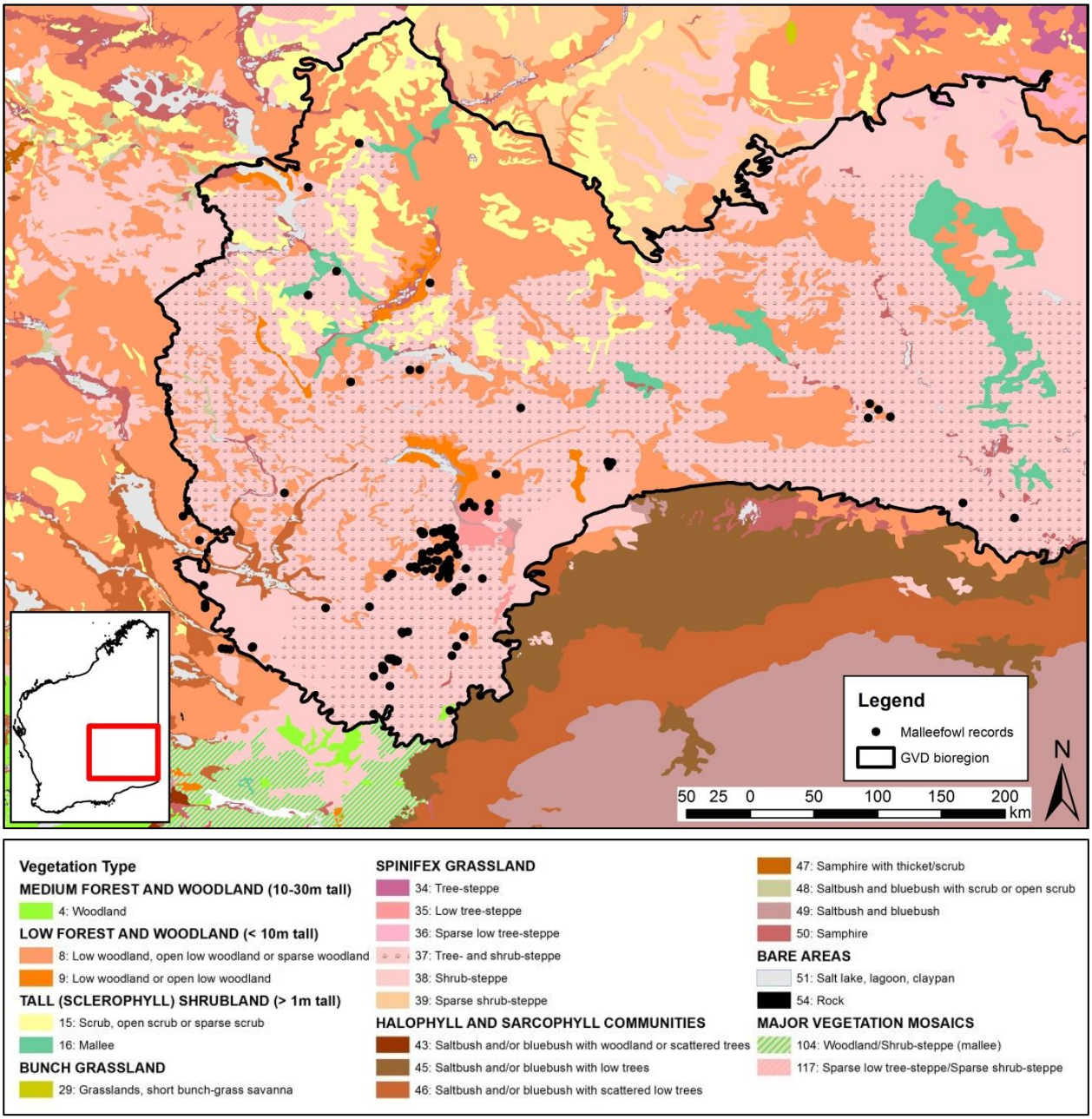


Figure 9a: Malleefowl records on vegetation types (Beard *et. al.* 2013).

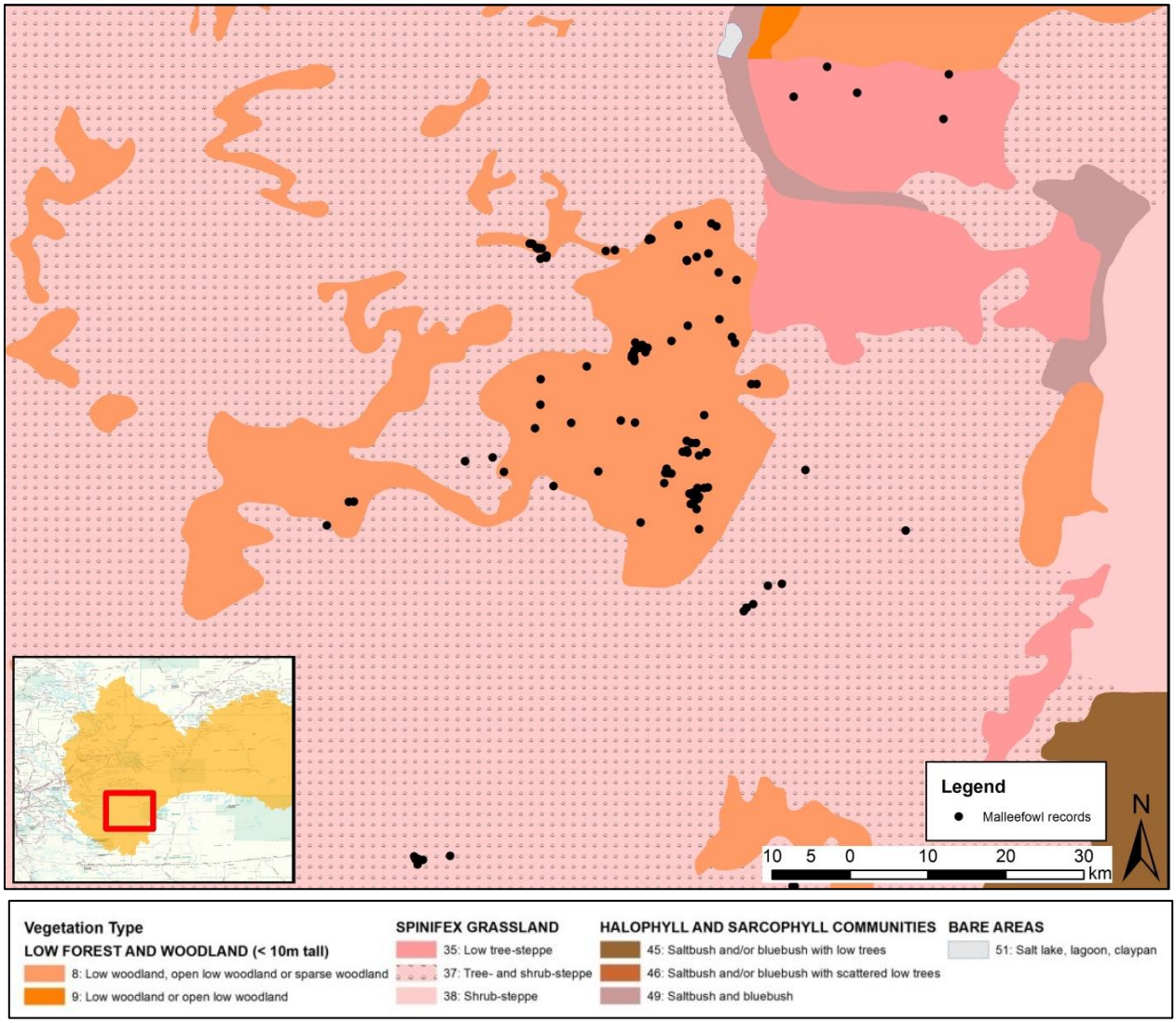


Figure 9b: Inset of majority of records on vegetation types (Beard *et. al.* 2013).

In terms of soil, sandplain is the characteristic regolith found in the Study Area but malleefowl sightings have mostly been on or near small sections of colluvium slope deposits (Fig. 10a and 10b). This may be because the mining activities are directly correlated with soil type. However, it may indicate that malleefowl in the Study Area prefer vegetation associated with soil from colluvium deposits.

Further survey, targeting different vegetation and soil types, will provide information to better define the vegetation (including litter) and soil requirements of this species, and confirm their dependence or preference for specific vegetation and soil types for nest building. Conservation strategies and management measures will then be able to be developed to ensure the maintenance of malleefowl in the GVD.

The soil layer used is the digital version 1:500 000 regolith map of Western Australia (preliminary edition) is based on published GSWA 1:250 000 and 1:100 000 series geological maps.

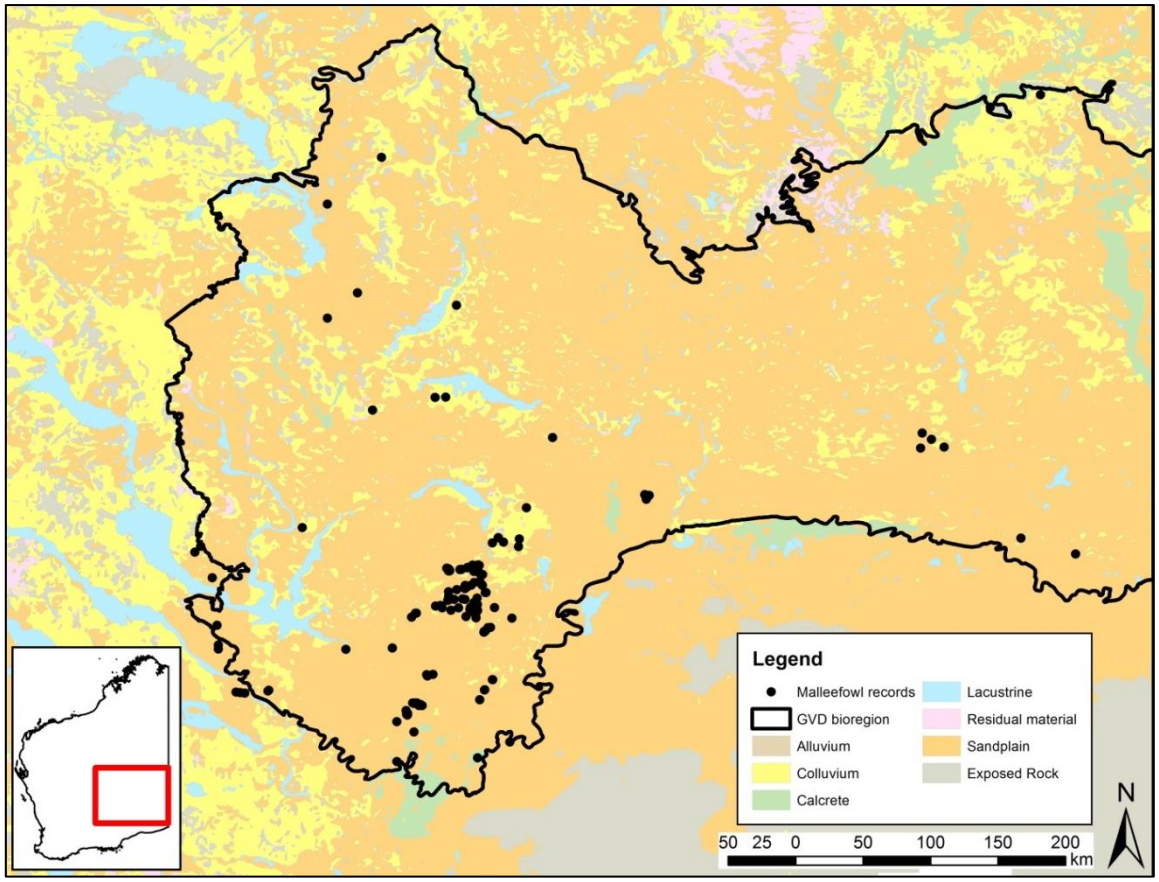


Figure 10a: Distribution of malleefowl records on soil (regolith) types.

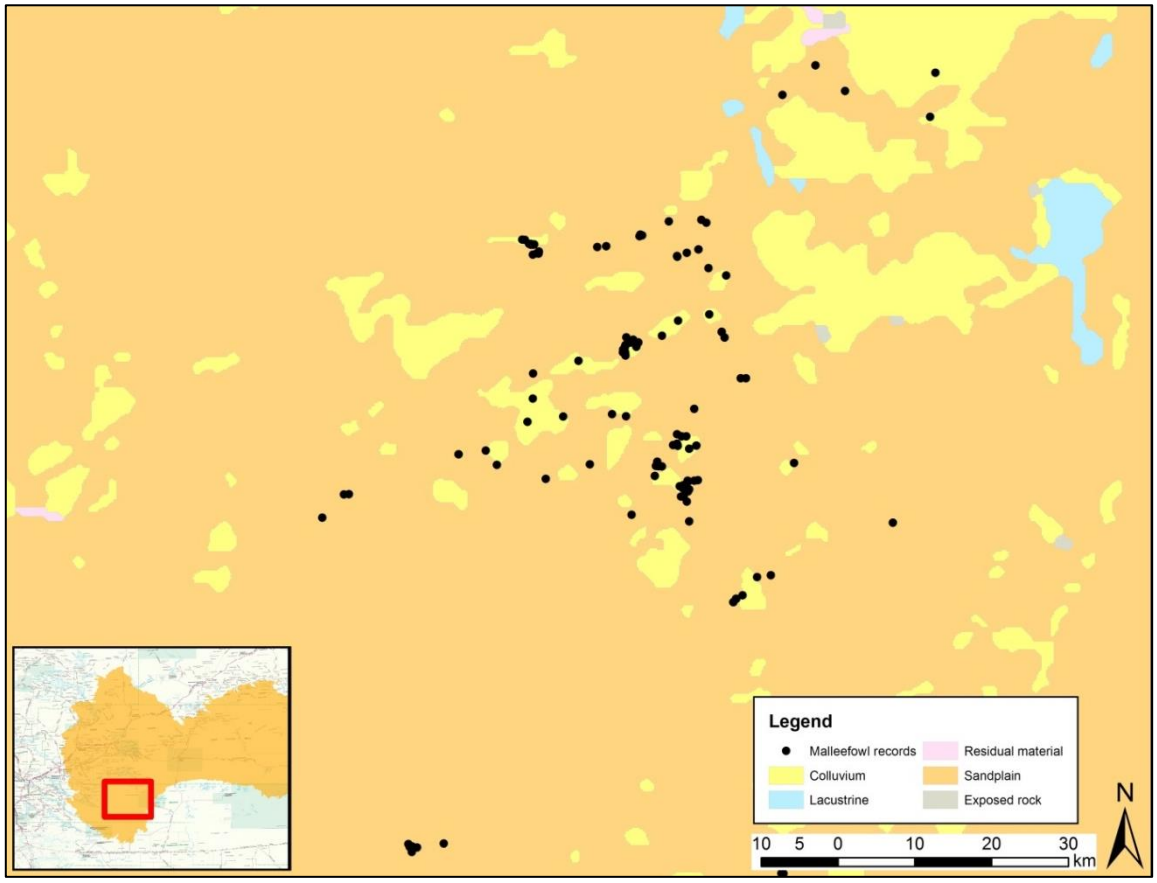


Figure 10b: Inset of majority of records on soil (regolith) types.

3.3.3 Sighting Type

Malleefowl mounds are the most common type of sighting, comprising 165 records in the database, compared to reports of birds (19 records) or other secondary signs (21 records) (Fig. 11a). It is unknown whether these mounds are monitored and if so how often.

The majority of the mounds are considered inactive, most estimated between 5-10 years old (Fig. 11b and 11c). Malleefowl are sporadic breeders in arid areas with unpredictable rainfall, so the inactive status of the majority of the mounds cannot be used to draw conclusions about the species' historic distribution in the GVD. In addition, many of the records lack information about the status (active or inactive) and estimated age of the mound, and this suggests that the mound descriptions may not be reliable:

- 40 mounds have no description regarding the state of the mound, and
- 19 of the 95 mounds reported as inactive have no estimated age.

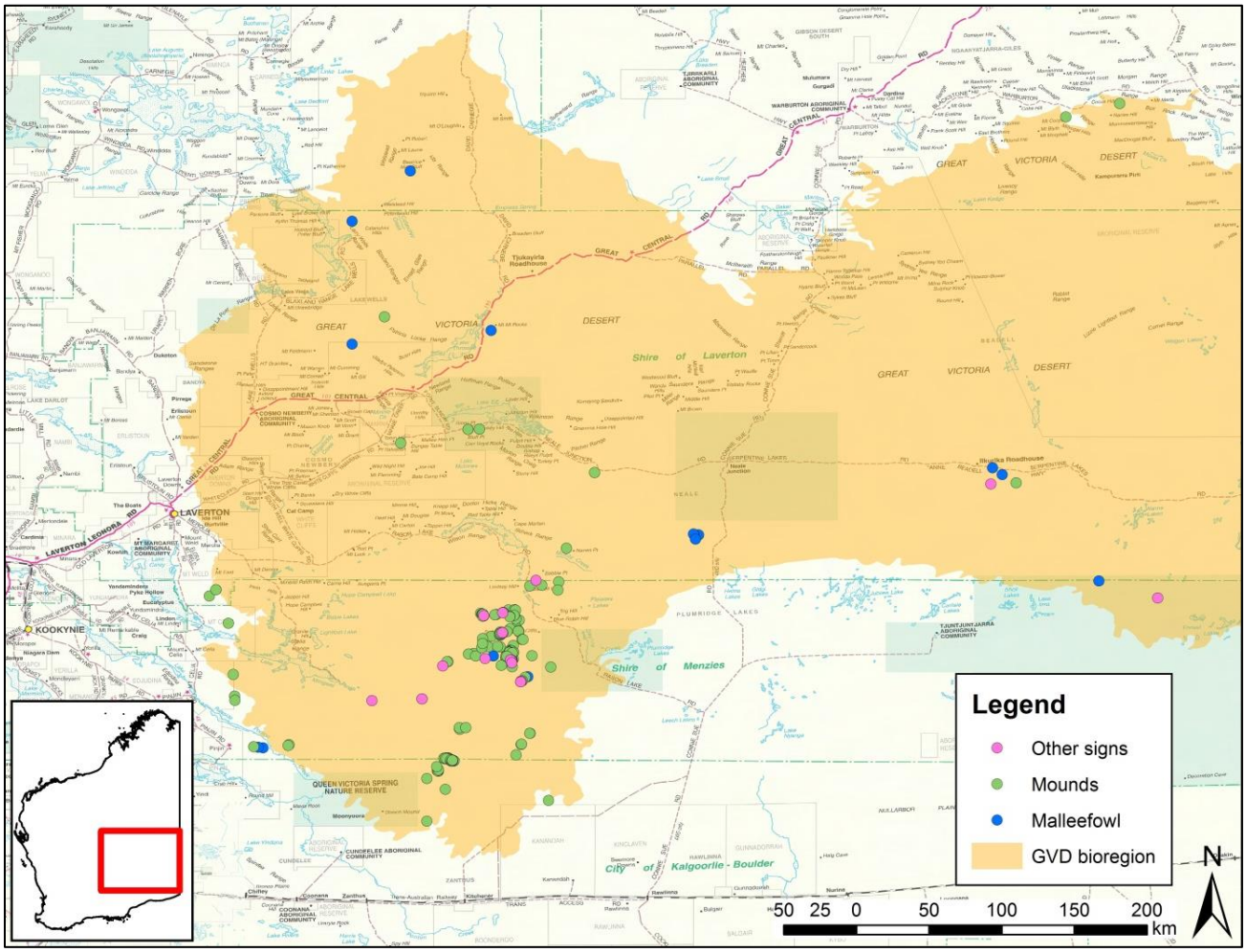


Figure 11a: Malleefowl sightings by type of sighting.

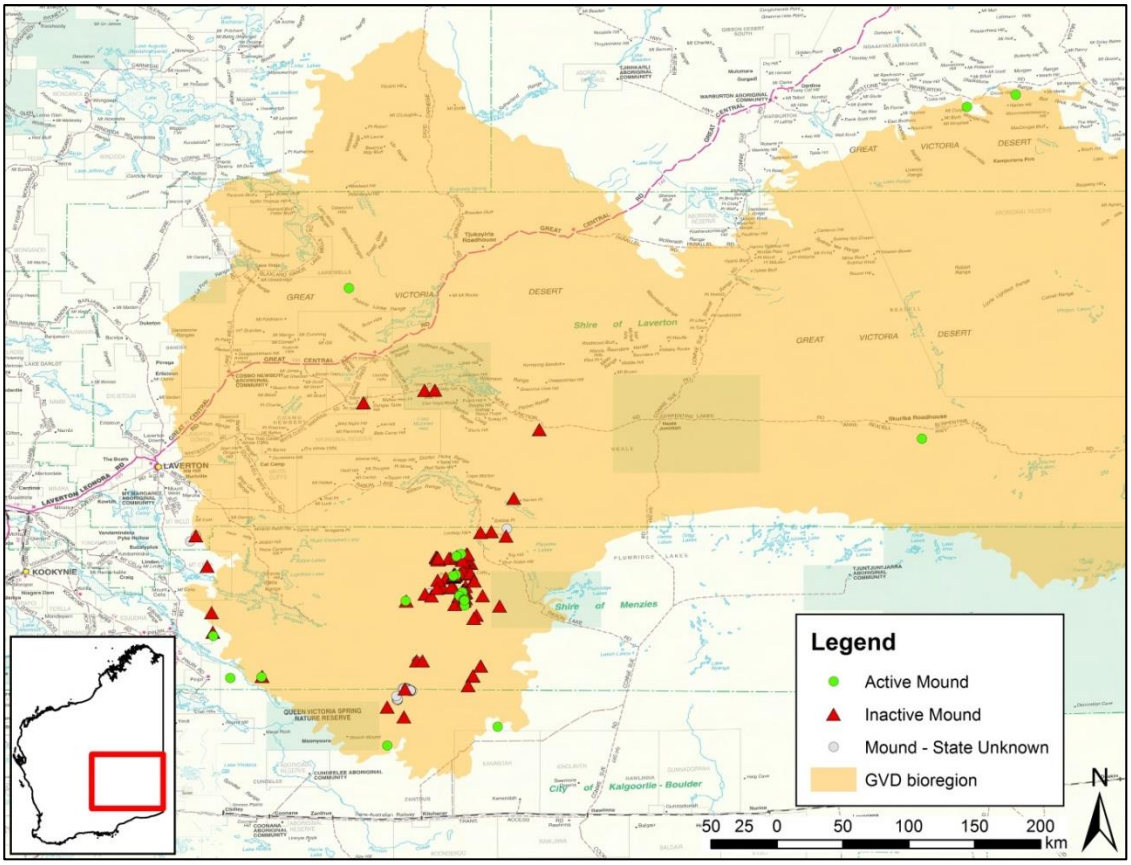


Figure 11b: Inactive verses active malleefowl mound records.

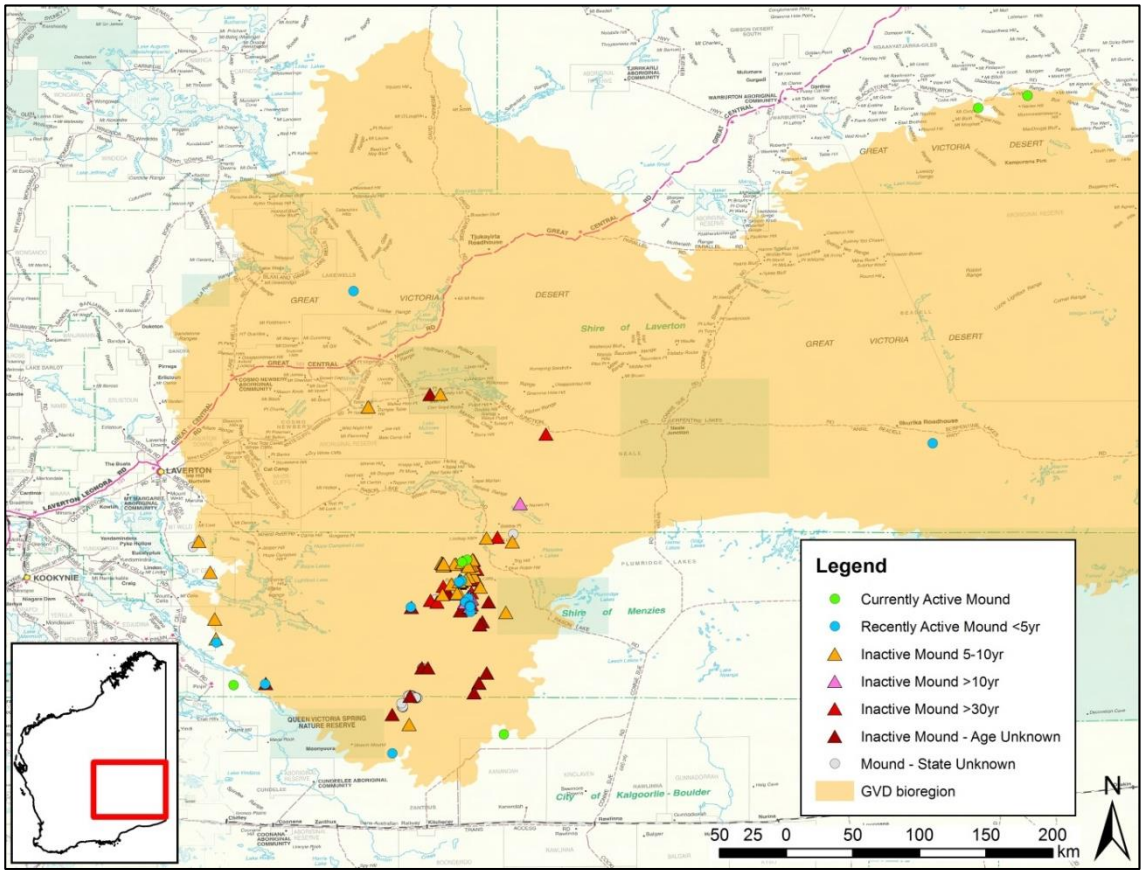


Figure 11c: Malleefowl mound records classified by age of mounds.

4. Project Outcomes

4.1 Project Outputs

The Department of Parks and Wildlife has completed the project commissioned by the Great Victoria Desert Biodiversity Trust within the three-month timeline. An active database has been produced for malleefowl records, historical and current, in the GVD with the possibility of expanding it to include all malleefowl sightings in the State of WA. All available data has been collated and entered into the database and any future malleefowl sightings will continue to be recorded in the same format. Other outputs from the project include a dedicated malleefowl webpage, species information sheets, report forms, protocols for data use and data input guidelines.

4.1.1 Webpage

The content for a species-specific webpage has been written and will be published on the Department's website. This webpage is aimed at informing the general public, and so it includes basic information on the biology, distribution and conservation status of malleefowl. There are links to the report forms, and to websites and pages with other relevant information. A section of the webpage focuses on the Trust and this project, with links to the GVDBT webpage and this report. Refer to Appendix 8 for the webpage content.

4.1.2 Information Sheets

The malleefowl profile sheet, which includes an in-depth summary of the species' biology, ecology and conservation status, has been updated with the most recent information available. A basic information page has also been written in less technical language, aimed at providing interesting facts about malleefowl for school-aged children. Both of these sheets will be linked to in the webpage, and are provided as Appendix 9.

4.1.3 Report Forms

A malleefowl report form has been produced, based on the existing threatened fauna report form that the Department has available on its website. The malleefowl report form requests information specific to the species that may not have necessarily been addressed in the generic threatened fauna report form. All stakeholders contacted during this project have been provided with the full version of the form, with the aim of gathering technical information about malleefowl sightings. A simplified, one-page version has also been created to encourage opportunistic sightings from the general public. Both report forms will be linked to in the webpage and are provided as Appendix 5.

4.1.4 Protocols for Data Use

Data from the Malleefowl Database will be publically and freely available through NatureMap, which has copyright, conditions of access and disclaimers outlined under the Help page. The data will be filtered to remove those columns determined to be confidential or contain sensitive information, such as the observer's name and contact details (unless prior consent is provided), scientific licence numbers and precise location information. The data can also be requested directly from the Department fauna.data@dpaw.wa.gov.au. The Department will follow its current protocols as outlined in the Database Search request information sheet. Any data supplied will have attached the Department's standard provisions for Threatened and Priority fauna information (see Appendix 6). If required, a specific data sharing agreement can be prepared for the GVDBT and the Department to use when supplying data extracted from the Malleefowl Database.

4.1.4 Data Input Guidelines

A set of guidelines for inputting data into the Malleefowl Database has been developed (see Appendix 7).

4.2 Barriers

Detailed analysis of the patterns and trends of malleefowl sightings has not been conducted as it was beyond the scope of this project but also because there are insufficient records in the database, and observer effort is biased towards mining tenements in the south-western portion of the Study Area. While few conclusions can be drawn from the data regarding species distribution, major gaps in our knowledge and information have been identified that can guide future research, monitoring and surveys, and management activities (see Section 4.3).

The project timeline ran from December to February, a time of the year when many people were on leave. As a consequence, not all stakeholders have been able to be contacted or have had adequate time to provide data. The Department is committed to input any records received subsequent to this project.

Traditional Owners (TOs) and Indigenous Ranger Groups (IRGs) were not contacted directly as part of this project. It has been agreed that this data would be best gathered as part of a coordinated approach involving the GVDBT's Adaptive Management partnership project and/or in association with other relevant on-ground projects in the region. Records provided by TOs and IRGs will be entered into the database by the Department when they become available through those processes. The Department will provide a report and the updated database to the GVDBT once these records have been entered.

To assist in guiding this future project and collation of additional malleefowl records, Table 6 provides recommendations regarding the relevant TOs and IRGs in relation to their likelihood of having malleefowl records, and/or living memory that may be converted into records. This is based on the Department's local networks and recent contacts with these groups. The recommendation is to target groups that may have formal survey data initially with a view to working with these groups to document living memory data.

Table 6: Traditional Owner and Indigenous Ranger Groups to contact for malleefowl sightings

TO/IRG	Contact Person	Known to have undertaken formal surveys?	Likelihood of having records or data?	Likelihood of having living memory and local knowledge
Pila Nguru Rangers	Shane Doudle	Some informal surveys, track surveys and camera trapping may have been undertaken	Moderate	High. Good local current and historical knowledge
Tjuntjuntjarra Community	Shane Doudle	Some informal surveys, track surveys and camera trapping may have been undertaken	Moderate	High. Good local current and historical knowledge
Cosmos Newberry	Harvey Murray	Nil or very minimal	Moderate	High
Ngaanyatjarra Council	Alex Knight, Bryony Nicholson	Have done some formal surveys	High	Very high
Ngaanyatjarra Rangers	Alex Knight, Bryony Nicholson	Have done some formal surveys	High	Very high
Wongutha Birni Aboriginal Corp.	GLSC Darren Forster	Nil	Nil	Some individuals

The fixed term fields for mound state and age require further review. There is currently not enough information on mound structure and erosion in the Study Area to provide definitive indications regarding the age of the structures. Stakeholders who provided information do not appear to have a 'universal' set of definitions for describing mounds, and much of the data lacks measurements and age estimations. The fixed term fields will be updated when further information specific to mound structure in the Study Area becomes available. It is recommended that this forms part of a future study incorporating consultation with experts with broad experience in the field of malleefowl mound monitoring (i.e. Joe Benshemesh).

4.3 Recommendations

The Malleefowl Database has the potential to be a useful resource for research, conservation and management purposes, particularly if the number and distribution of records can be increased. To ensure that it continues to improve, it is recommended that project participants and stakeholders continue to raise awareness of the database and the ongoing collation of sightings information.

There is a clear need for surveys across the region that target malleefowl specifically. Past and current survey effort is biased towards mining tenements in the south-western portion of the Study Area. These surveys, though biased in focus area, demonstrate that targeted surveys can detect the species in the Study Area and as such are worth carrying out. Survey effort should initially be targeted to areas with few or no malleefowl records, and include a range of vegetation and soil types, and land management practices.

This project identified the possible patterns of associations with vegetation assemblages and/or soils in relation to malleefowl in the GVD region. Further species-targeted surveys are required to understand the species current distribution and habitat preferences and requirements of malleefowl in the GVD. Once

patterns relating to vegetation and/or soil assemblages are demonstrated, these variables could be used to inform future survey effort, and inform conservation and management actions.

From a conservation perspective, understanding trends over time are important so in addition to surveys to determine distribution, monitoring over time is also recommended. A series of monitoring sites in key areas would be ideal to determine breeding activity and outputs. These could be targeted to also better understand the level of threat from land uses and land management practices.

The South Australian Friends of the Great Victoria Desert Parks voluntarily assist the SA Department for Environment, Water and Natural Resources and the Alinytjara Wilurara Natural Resource Management Board with field work, including surveying malleefowl habitat and monitoring known mounds. This group is a good example of a citizen science approach where community groups and tourists can be an important source of information, especially in remote areas without major towns like the GVD. Similar groups in WA could be contacted to generate interest in reporting opportunistic sightings or surveying for malleefowl in the region. Providing basic species information to tourists may also increase the number of sightings reported.

Developing partnerships with TOs and IRGs are important for capturing living memory records and historical and current records not available from any other sources. These partnerships will also be important for any future survey or monitoring projects and management programs.

In terms of research, there is a vast source of published journal articles on malleefowl and their ecology and biology, but very little of it is specific to malleefowl in arid environments like the GVD. This lack of information affects how sightings are reported (e.g. mound age is rarely defined) and how monitoring and management activities are conducted. It is recommended that future research focus on:

- Studying the biology of malleefowl in the GVD, including egg incubation timelines, hatchling survival rates, frequency of mating/nesting and adult home ranges;
- Understanding the distribution and abundance of the species in the GVD, and subsequently monitoring trends to inform conservation status and management;
- Confirming whether the identified patterns regarding malleefowl vegetation and soil preferences hold true across the GVD landscape, followed by identification, mapping and search of suitable habitat types;
- Identifying and understanding the threats to malleefowl in the GVD; and
- Assessing mound age and structure in the GVD considering the climate, substrate and vegetation characteristic to the region.

4.4 Conclusion

The aim of the project was to collect and collate all available presence data of malleefowl in the WA section of the GVD (the Study Area) to provide a foundation for understanding and investigating malleefowl distribution across the region. The collation of available presence data has been achieved but ongoing effort will be required to source records that may be less accessible or more obscure. The project has highlighted that further survey, monitoring and research effort is needed to understand the status of the species in the Study Area, its habits, threats and implications for management. However, the development of a database is a useful first step in this process that can continue grow.

Appendix 1: Expression of Interest

Expression of Interest

Malleefowl Records in the GVD

Background

The Great Victoria Desert Biodiversity Trust (the Trust) is a newly established organisation with the aim of facilitating priority research and on-ground activities to promote the conservation of threatened species in the Great Victoria Desert (GVD). The Trust's activities will primarily focus on two subregions of the GVD, Shield and Central.

As part of this aim, the Trust is working with Department of Parks and Wildlife to consolidate all existing data of Malleefowl (*Leipoa ocellata*) records in the WA areas of the Great Victoria Desert. To fulfil this aim the Trust is seeking submissions from suitably qualified parties to collect and collate this data. The aim of this program is to collect and collate all available data to provide the foundation for understanding and investigating Malleefowl distribution across the GVD.

Scope of Work

This project is perceived as a desktop data collection and collation exercise, it is not perceived as a field survey program, although it is acknowledged that some field work may be required to engage with Interested Individuals and especially Traditional Owners.

To capture Malleefowl records, the Proponent is expected to contact individuals and groups who have or are currently operating in the region. These groups should include:

- Traditional Owners
- Mining and exploration companies
- Environmental consultants
- Government departments
- Environmental not-for-profits
- Universities / research organisations, and
- Interested Individuals

Data captured should include sightings, mounds and other secondary evidence indicating Malleefowl presence (feathers, eggshells, footprints, remains).

As part of this project, the collected data, is expected to be rated for quality and reliability and reconciled with current data capture databases including NatureMap, Birdata, the Atlas of Living Australia and the National Malleefowl Monitoring System.

Data should be captured in a format that will allow it to be imported into a database in a consistent manner.

Information will be made publically available, where possible. Where appropriate threatened species data will be obscured in line with the Department of Parks and Wildlife's NatureMap policies.

Key Deliverables

- A report on the Malleefowl records in the GVD including a map and data sources
- Data files (provided electronically on disk) including details for each record

Timing

The project is expected to be delivered within three month of the awarding of the project to the successful proponent. Proponents should outline their timing in terms of start date and length of time required to complete the project.

Selection Criteria

The Contract may be awarded to a Proponent who best demonstrates the ability to provide quality services at a competitive price. The quoted cost will be assessed alongside the Proponent's responses to the EOI requirements to determine the best outcome to the Trust. The Trust has adopted a best value for money approach to this EOI. This means that, although price is considered, the EOI containing the lowest price will not necessarily be accepted, nor will the offer ranked the highest on the qualitative criteria. A scoring system will be used as part of the assessment of the qualitative criteria. Unless otherwise stated, an EOI that provides all the information requested will be assessed as satisfactory. The extent to which a Proponent demonstrates greater satisfaction of each of these criteria will result in a greater score. The aggregate score of each Proponent will be used as one of the factors in the final assessment of the qualitative criteria and in the overall assessment of value for money.

EOI Requirements

In order to be assessed, please ensure your EOI contains the following information:

1) Evidence of relevant experience:
   - in Malleefowl research
   - in collaborating with diverse stakeholders, some whom may be remote; and
   - previous experience with data capture, collation and management
2) Methodology for obtaining records and standardising information
3) Timeframe and proposed schedule for key deliverables
4) Detailed costs and expenses of the project
5) Level of Proponent's co-investment and in-kind afforded to the project

The Proposal must be received, via email, by no later than 5pm, 31 July 2015. You will receive a confirmation once it has been received. If you have any question in relation to this EOI request, please contact Kathryn Sinclair, Trust Co-ordinator, on Kathryn.sinclair@gvdbiodiversitytrust.org.au.

The EOI should be no longer than five pages long.

Appendix 2: Species Details

The following species details are included in the databases available in Nature Map but are not essential for the Malleefowl Database.

Table 7: Malleefowl species information

Species Code	Name ID	Family	Genus	Species	Author	Vernacular	WA Conservation Status
AVMELEOC	24557	Megapodiidae	Leipoa	ocellata	Gould, 1840	malleefowl	Threatened - Vulnerable

Appendix 3: Extracted Databases

The following databases in Nature Map were searched for malleefowl records, although only TFAUNA, FAUNASURVEY and BIRDATLAS2 have records within the Great Victoria Desert. All databases will be checked for new records as they are updated in Nature Map.

Table 8: Databases with malleefowl records

Source Code	Database Name	Database Owner
TFAUNA	Threatened Fauna	Department of Parks and Wildlife
FAUNASURVEY	Fauna Survey Returns	Department of Parks and Wildlife
BIRDATLAS1	Atlas of Australian Birds (Historical)	Bird Life Australia
BIRDATALS2	Atlas of Australian Birds	Bird Life Australia
ALA_COLLECTIONS	ALA Observations of WA Species, ALA Vouchered Collections of WA Species	Atlas of Living Australia
WAM_BIRDS	Western Australian Museum Bird Specimens	Western Australian Museum

Appendix 4: Fixed Term Fields

Certain fields in the database have been assigned a set of terms (i.e. no free text) so that data entry is standardised and specific to malleefowl characteristics. Table 9 through to Table 12 define these fixed terms, and these are also provided in the Malleefowl Database.

Table 9: Specimen type

Fixed Terms	Definition
Frozen carcass	Fresh carcass currently kept in freezer
Degenerated carcass	Carcass collected is decomposing or mummified.
Spirit specimen	Carcass is kept in a specimen jar with a liquid preservative
Taxidermy specimen	Taxidermy of carcass
Skull/Bones	Skull or bones collected
Scats	Scats collected
Egg	Unhatched or hatched egg collected
Feathers	One or more feathers collected
Tissue/Blood Sample	A tissue or blood sample has been taken from a fresh carcass or live animal
Other Specimen Type	Other specimen type that has not been defined; details should be provided in Observation Comments.
No Specimen	Specimen has not been collected

Table 10: Land tenure codes

Fixed Terms (Code)	Definition
PP	Private Property
NR	Nature Reserve
NP	National Park
AR	Aboriginal Reserve
UCL	Unallocated Crown Land
SR	Shire Reserve
PL	Pastoral Lease
ML	Mining Lease (incl. exploration licences)
RVM	Road Verge – Main Roads WA
RVS	Road Verge - Shire
SF	State Forest

Table 11: Habitat description – landform and vegetation codes

Habitat Description Field	Fixed Terms (Code)	Definition
Landform	CAV	Cave
	CLI	Cliff
	CLO	Closed depression
	CRE	Crest
	CRK	Creek
	DRA	Drainage Line
	FLA	Flat
	GUL	Gully
	HIL	Hill
	LAK	Lake
	OPE	Open Depression
	RID	Ridge
	RIV	River
	SAN	Sand Dune
	SLO	Slope
	SWA	Swamp
	WET	Wetlands
	OTH	Other (Should be briefly described in Vegetation Description)
Vegetation Type	FAR	Farm
	FOR	Forest
	GAR	Garden
	GRA	Grassland
	HEA	Heathland
	MAL	Mallee
	ORC	Orchard
	PAR	Park
	PLA	Plantation
	ROC	Rock Communities
	SED	Sedgeland
	SHR	Shrubland
	WET	Wetland
	WOO	Woodland
	OTH	Other (Should be briefly described in Vegetation Description)

Table 12: Observation details – method, observation type, breeding status

Observation Details Field	Fixed Terms	Definition
Method	Survey	Scientific examination of biological features of an area, type of survey not defined.
	Survey – Level 1	Reconnaissance survey of target area with selective, low intensity sampling of fauna, and habitat descriptions and maps.
	Survey – Level 2	Detailed survey of target area and general locality over multiple visits and seasons.
	Survey – Biological	Comprehensive survey of a region using multiple survey techniques over multiple visits and seasons
	Survey – Targeted	A survey targeting a specific species
	Survey - Census	A survey to determine the range of species present
	Monitoring	Surveillance of biological features of an area over time, regularity of monitoring not defined.
	Monitoring – Regular	Monitoring at regular intervals (biannual, annual)
	Monitoring – Occasional	Monitoring at occasional intervals (>5yrs)
	Opportunistic/Incidental	One-off sightings (not part of survey or monitoring program)
Observation Type	Camera – remote sensor	Captured on remote sensor camera
	Camera baited	Captured on a baited camera
	Trapping	Trapped/caught as part of survey or monitoring program
	Sighting	Sighting of bird – time of day not defined
	Sighting – day	Day sighting of bird
	Sighting - night	Night sighting of bird
	Sighting – dawn	Dawn sighting of bird
	Sighting – dusk	Dusk sighting of bird
	Spotlighting	Bird seen while conducting spotlight survey
	Dead	Bird found dead
	Heard	Bird call heard or recorded
	Secondary signs	Secondary signs include: eggs, mounds, diggings, scratchings, tracks, scats, feathers and bones
		All columns must be filled out with a numerical value to denote how many birds were sighted. A zero (0) should be entered if no birds were seen.
	Total Individuals	
	Adult - Male	
	Adult- Female	

	Adult - Unknown	
	Juvenile - Male	
	Juvenile – Female	
	Juvenile - Unknown	
	Hatchling	
Adult	A number is entered for each column, specifying how many of each was seen. At least one column per row must have a value of 1 (or greater than 1) entered into it.	This value must match the number of adults (female, male and unknown sex) in the Number of Individuals category.
Juvenile		The juvenile and hatchling values must match the total number of juveniles (female, male and unknown sex) in the Number of Individuals category
Hatchling		
Egg – unhatched		Eggs can be hatched or unhatched.
Egg shell		
Mound – state unknown		State of mound has not been described.
Mound – active (at time of survey)		Mound is in use at time of sighting (birds are mound building, mating or laying, eggs have been laid, and/or hatchlings are emerging).
Mound – active (recently used)		Mound shows signs of recent use (fresh mound building, freshly hatched eggs)
Mound - inactive		Mounds do show no signs of recent use and no known use within 10 years
Diggings/Scratchings		Diggings include mound building that has not been completed or has not been used for egg laying.
Tracks		Other secondary signs of the species.
Scats		
Feathers		
Bones		
Estimated Age of Mound	<2 years	Mound is active at time of survey or shows signs of very recent use
	<5 years	Signs of recent use
	>5 years	No recent signs of activity but has not yet eroded and no vegetation has established
	<10 years	No recent signs of activity, slight weathering
	>10 years	No recent signs of activity, slight weathering, natural litter accumulation
	>30years	No recent signs of activity, mound has eroded considerably, vegetation is growing in mound.
Breeding Status	Eggs in mound	Eggs found in mound or mound is closed and shows signs of incubating

	Hatchling emergence	Hatchlings seen emerging from mound or there is evidence that eggs have hatched
	Mating	Birds seen mating
	Mound building	Birds seen building mound or mound shows signs of recent workings
	Unknown	Age of mound not specified
		This column can be left blank if there are no signs of breeding

Appendix 5: Malleefowl Report Form

Full Version

Department of Parks and Wildlife

Malleefowl Report Form

Version 1.0 January 2016

SPECIES NAME: *Leipoa ocellata* (malleefowl) **NUMBER SEEN:**

OBSERVATION DATE: TIME: am/pm

OBSERVER NAME/S:

Organisation / Company:

Role / Position / Job title:

Address:

EMAIL: PHONE:

OBSERVATION LOCATION: (i.e. property address, distance to nearest intersection, reserve name, locality, nearest town, distance and direction to that place)

DISTRICT: LGA: Reserve No:

DATUM:
- GDA94 / MGD94 ☐
- AGD84 / AMG84 ☐
- WGS84 ☐
- Unknown ☐

COORDINATE TYPE:
- Decimal Degrees ☐
- Degrees Minutes Seconds ☐
- UTM ☐

(If UTM coords provided, **Zone** is required)

COORDINATE SOURCE:
- GPS ☐
- Differential GPS ☐
- Map ☐
- Google Earth/Maps ☐
- GIS (i.e. ArcMap) ☐

ACCURACY OF COORDINATES: (±)
- 30m ☐ 10km ☐
- 300m ☐ 50km ☐
- 1km ☐ 100km ☐

Specific distance (m):

Latitude/Northing: No. satellites:

Longitude/Easting: Map/atlas title:

Zone: Map scale:

FD Grid Ref: Other:

LAND TENURE:

Nature Reserve ☐	State Forest ☐	Private Property ☐	Rail Reserve ☐	Aboriginal Reserve ☐	Shire Reserve ☐
National Park ☐	Timber Reserve ☐	Pastoral Lease ☐	Rd Res. MRD ☐	State Waters <5.4km ☐	Other (Specify) ☐
Conservation Park ☐	Water Reserve ☐	UCL ☐	Rd Res. Shire ☐	Marine Park ☐	

CERTAINTY OF ANIMAL IDENTIFICATION:

Certain ☐	Photo ☐
Moderately certain ☐	Specimen ☐
Not sure ☐	Identified by expert ☐

AGE AND SEX:

Number of Adults:		Number of Juveniles:		Number of Hatchlings:	
Male	____	Male	____	Male	____
Female	____	Female	____	Female	____
Unknown	____	Unknown	____	Unknown	____

Expert name, qualifications, affiliation:

DISTINGUISHING FEATURES / DESCRIPTION OF OBSERVED ANIMAL:

ANIMAL ACTIVITY:

Please return form to:

fauna@dpaw.wa.gov.au

or Species and Communities Branch, Department of Parks and Wildlife, Locked Bag 104, Bentley Delivery Centre WA 6983

*Record entered by:*_____ *Date entered:*_____ *Database no:*_____

Department of Parks and Wildlife

Malleefowl Report Form

Version 1.0 January 2016

OBSERVATION METHOD: (Select as many as applicable)

Survey	Monitoring	Other
Level 1 or 2 survey ☐	Regular monitoring ☐	Opportunistic/Incidental ☐
Targeted survey ☐	Occasionaly monitoring ☐	Other: (Please specify)
Census survey ☐		

OBSERVATION TYPE: (Select as many as applicable)

Live	Dead	Secondary signs		Historical evidence
Day sighting ☐	Roadkill ☐	Egg ☐	Scats ☐	Subfossil material ☐
Night sighting ☐	Found shot ☐	Egg shell ☐	Bones ☐	Fossil ☐
Dawn sighting ☐	Found poisoned ☐	Mound ☐	Diggings ☐	
Dusk sighting ☐	Killed by another animal ☐	Feathers ☐	Scratchings ☐	Living knowledge (verbal) ☐
Remote camera ☐	Bones ☐	Tracks ☐	Heard ☐	Historical account (written) ☐
Baited camera ☐	Degenerated carcass ☐			
Trapped ☐	Unknown cause of death ☐			
Spotlighting ☐				
Other: (Please specify)	Other: (Please specify)	Other: (Please specify)		Other: (Please specify)

Specific observations:

Malleefowl egg and egg shell:

Egg unhatched ☐
Egg hatched, recent ☐
Egg hatched, old ☐

Malleefowl mound: state, approximate age and dimensions

Active, at time of sighting ☐	2 years old ☐	Estimate mound dimensions:
Active, recently used ☐	5 years old ☐	
Inactive ☐	10 years old ☐	
State unknown ☐	>30 years old ☐	

REPRODUCTIVE STATE:

Non-breeding ☐	Mound building ☐	Eggs in mound ☐	Other: (Please specify)
Not known ☐	Mating ☐	Hatchling emergence ☐	

Other observation details:

SPECIMEN: (Select as many as applicable)

Frozen carcass ☐	Taxidermy specimen ☐	Egg ☐	No specimen / not retained ☐
Degenerate carcass ☐	Skull and/or bones ☐	Feather ☐	Other: (Please specify)
Spirit specimen ☐	Tissue and/or blood sample ☐	Scats ☐	

Specimen location:

WA Museum ☐	Other Museum / collection ☐	Given to DPaW Office ☐	Retained by collector ☐
WA Museum Catalogue No.	Museum / collection name and Catalogue No.	Please specifiy office location and contact name:	Collectors Reference No.

Specimen identified by (name, qualifications, affiliation etc.):

Please return form to:

fauna@dpaw.wa.gov.au

or Species and Communities Branch, Department of Parks and Wildlife, Locked Bag 104, Bentley Delivery Centre WA 6983

*Record entered by:*_____ *Date entered:*_____ *Database no:*_____

Department of Parks and Wildlife

Malleefowl Report Form

Version 1.0 January 2016

HABITAT INFORMATION:

LANDFORM:

				Other: (Please specify)
Cave ☐	Rocky outcrop ☐	Beach ☐	Swamp ☐	
Cliff ☐	Flat ☐	Ocean ☐	Wetland ☐	
Crest ☐	Gully ☐	Creek ☐	Drainage line ☐	
Hill ☐	Sand dune ☐	Lake ☐	Open depression ☐	
Ridge ☐	Slope ☐	River ☐	Closed depression ☐	

VEGETATION TYPE:

				Other: (Please specify)
Forest ☐	Shrubland ☐	Sedgeland ☐	Garden ☐	
Woodland ☐	Heathland ☐	Rock communities ☐	Orchard ☐	
Mallee ☐	Grassland ☐	Wetland ☐	Plantation ☐	

SOIL TYPE: (Please specify)

Associated flora species, ecological communities, and other habitat details:

FIRE HISTORY: **Last Fire:** Season/Month: _____ Year: ____ **Fire Intensity:** High ☐ Medium ☐ Low ☐ No signs of fire ☐

OTHER COMMENTS:

ATTACHED: Map ☐ Mudmap ☐ GIS data ☐ Photo ☐ Field notes ☐ Other:

COPY SENT TO: Regional Office ☐ District Office ☐ Other:

Submitter of record: _____ **Role:** _____ **Date submitted:** _____

Signature: _____ **Organisation:** _____

Contact Details:

Please return form to:

fauna@dpaw.wa.gov.au

or Species and Communities Branch, Department of Parks and Wildlife, Locked Bag 104, Bentley Delivery Centre WA 6983

*Record entered by:*_____ *Date entered:*_____ *Database no:*_____

Simple Version

Department of Parks and Wildlife

Malleefowl Report Form

Version 1.0 January 2016

ANIMAL NAME: Malleefowl (*Leipoa ocellata*) **NUMBER SEEN:**

OBSERVATION DATE: TIME:

OBSERVER NAME/S:

EMAIL: PHONE:

ADDRESS:

OBSERVATION LOCATION (Coordinates - latitude and longitude, property address, distance to nearest intersection, etc.)

CERTAINTY OF ANIMAL IDENTIFICATION:

- Not sure ☐
- Moderately certain ☐
- Certain ☐
- Photo ☐

DESCRIPTION OF MALLEEFOWL (Include comparisons e.g. similar size to chicken, number of adults and juveniles etc.)

OBSERVATION TYPE: (Select as many as applicable)

Live	Dead	Secondary signs	
Day sighting ☐	Roadkill ☐	Mound ☐	Scats ☐
Night sighting ☐	Found shot ☐	Egg or shell ☐	Diggings ☐
Remote camera ☐	Found poisoned ☐	Feathers ☐	Heard ☐
Trapped ☐	Killed by another animal ☐	Tracks ☐	Bones ☐
Spotlighting ☐	Unknown cause of death ☐		

OBSERVATION DETAILS (What was the mallefowl doing? Mound description, habitat type, associated flora species etc.)

OTHER COMMENTS (Include details of additional data available and how to locate it, land tenure and use, fire history etc.)

ATTACHED: Map ☐ Mudmap ☐ GIS data ☐ Photo ☐ Field notes ☐ Other:

COPY SENT TO: Regional Office ☐ District Office ☐ Other:

Submitter of record:	**Role:**	**Date submitted:**

Please return form to:

fauna@dpaw.wa.gov.au

or Species and Communities Branch, Department of Parks and Wildlife, Locked Bag 104, Bentley Delivery Centre WA 6983

Record entered by: _____ *Date entered:* _____ *Database no:* _____

Appendix 6: Conditions of Supply

THREATENED AND PRIORITY FAUNA INFORMATION

Conditions with Respect to the Supply of Information

- The data supplied may not be provided to any other organisations, nor be used for any purpose other than for the project for which it has been originally provided for; without the prior consent of the Executive Director, Department of Parks and Wildlife.
- Specific locality information for threatened fauna is regarded as confidential, and should be treated as such by receiving organisations. Specific locality information for threatened fauna may not be used in reports without the written permission of the Executive Director, Department of Parks and Wildlife. Reports may only show generalised locations at a low resolution or, where necessary, show specific locations without identifying species. Species and Communities Branch is to be contacted for guidance on the presentation of threatened fauna information.
- The Department of Parks and Wildlife respects the privacy of private landowners who may have threatened and priority fauna on their property. Threatened and priority fauna locations identified in the data as being on private property should be treated in confidence, and contact with property owners must only be made through the Department of Parks and Wildlife.
- Acknowledgment of the Department of Parks and Wildlife as the source of data is to be made in any published material and cited as Parks and Wildlife (2015) Threatened and Priority Fauna Database Search for [search area] accessed on the [date of search]. Prepared by the Species and Communities Branch for [Requesters name and company] for [purpose of search].
- Copies of all such publications are to be forwarded to the Department of Parks and Wildlife, Attention; Principal Zoologist, Species and Communities Branch.

Disclaimers with Respect to the Supply of Information

- Receiving organisations should note that while every effort has been made to prevent errors and omissions in the data, they may be present. The Department of Parks and Wildlife accepts no responsibility for this.
- Receiving organisations must also recognise that the database is subject to continual updating and amendment, and such considerations should be taken into account by the user.
- It should be noted that the supplied data does not necessarily represent a comprehensive listing of the threatened fauna of the area in question. Its comprehensiveness is dependent on the amount of surveys carried out within a specified area. The receiving organisation should consider engaging a biologist/zoologist, if required, to undertake a survey of the area under consideration.

Appendix 7: Malleefowl Database Guidelines

INSTRUCTIONS ON ENTERING RECORDS INTO THE MALLEEFOWL DATABASE

1. Check if the observer has provided the minimum information required:
    - What was sighted? (bird, mound, other secondary signs)
    - Where was it seen? (Coordinates or location description)
    - When was it seen? (Day, month and year; or the 1st of January if only the year is provided)
2. Contact the observer if they have not provided adequate details. Enter the information that is provided into the database but note in the Comments field that the record is being followed-up.
3. Double check the location details in a GIS-based mapping program.
    - If coordinates have not been provided with the location description, use the GIS program to determine the latitude and longitude. The resolution for these coordinates should be set at 1km.
    - Latitude and longitude must be designated to four decimal points, and a zone must be allocated for Eastings and Northings.
    - Use a tenure layer in the GIS program to add any extra land tenure information or site details (e.g. mining tenement licence or reserve number)
4. Use the GIS program to double check or to determine the Locality Name, Land Tenure, Local Government Area and District.
5. Fill in all free-text columns possible. See *Appendix 4: fixed term fields* for explanations on how to fill in each column.
6. Fill in all fixed term fields as outlined in Appendix 4 of the Malleefowl Database.
7. Review the reliability and quality of the data in terms of certainty of species identification and accuracy of spatial coordinates (see Information Sheet for the Malleefowl Database).
    - Consider observer's qualifications and the type of sightings when determining the certainty of the record.
8. Enter your initials and the date of entry (or date of update) into the Checked Name and Checked Date columns after the record has been entered and reviewed. These columns should be left blank only if the record is missing required information or if some information cannot be confirmed.
9. Allocate all new records that are not extracted from an existing database with a SourceID number from the Threatened Fauna Database.

Appendix 8: Draft Webpage Content

Webpage content will be finalised pending final endorsement, and will be updated as required and as new information becomes available.

Malleefowl *Leipoa ocellata*

Malleefowl (*Leipoa ocellata*) are large, ground-dwelling birds that rarely fly unless alarmed. They are approximately the size of a domestic chicken, with adults weighing between 1.5 and 2.5kg. Malleefowl create nests comprised of a large mound of soil covering a central core of leaf litter that can span up to 5m in diameter and 1m in height. They are one of three mound building bird species in Australia, along with the orange-footed scrubfowl *Megapodius reinwardt* and the Australian brush-turkey *Alectura lathami*.

Figure 1: The feathers of a malleefowl are highly distinctive (D. Curtis, 2015 ©)

Malleefowl are recognised as a threatened species under State and Commonwealth legislation. In Western Australia the species is listed as fauna considered to be facing a high risk of extinction in the wild (Specially Protected) under the Wildlife Conservation Act 1950 and has been assigned the threat status ranking of vulnerable using International Union for Conservation of Nature (IUCN) criteria. Nationally it is listed as vulnerable under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999, and internationally on the IUCN Red List of Threatened Species as vulnerable.

Where malleefowl are found

Historically, malleefowl were found in the semi-arid mallee shrublands and woodlands across southern Australia in New South Wales, Victoria, South Australia, Northern Territory and Western Australia. Today, the species is still found in most of these areas but has had local extinctions in the NT, northern SA and far south-west WA, and its remaining range is highly fragmented due to extensive land clearing.

In WA, malleefowl are most commonly seen in reserves and private property within and around the Wheatbelt region. Recent surveys in the Goldfields have also noted that malleefowl continue to persist in this arid region. Conservation areas where they are known to occur include the areas surrounding Dryandra State Forest, Fitzgerald River National Park, Stirling Range National Park, Kalbarri National Park, Mount Manning – Helena and Aurora Ranges Conservation Park. They have also been reintroduced to Francois Peron National Park in Shark Bay.

Refer to Nature Map for further information regarding the distribution of this species.

How to spot a malleefowl

Malleefowl can be very hard to spot because they camouflage so well with their natural environment. They are characterised by the distinct grey, black and white banding across its body and wings. The breast and belly are

cream-white, and its neck and head are greyish with a white stripe under the eye. A dark crest extends from the front of the crown to the nape and is raised when the bird is alarmed.

Malleefowl are typically quiet-moving and will often freeze or move quietly away when disturbed, but they are also known to burst up over trees with heavy flapping. The male malleefowl makes a deep, two-note bellowing or booming, or loud clucks. The female makes a high-pitched crowing, soft crooning or low grunting.

Malleefowl mounds can be a highly distinctive feature in a landscape, particularly if they have been recently used. A malleefowl pair will often use the same mound each breeding season rather than building a new one. The eggs, pale pink to pale brown in colour, are buried within the nest. The male tends to the mound, regulating the temperature inside the central pocket until the chicks hatch at 7 weeks. The chicks can fly and fend for themselves within several hours of digging to the surface unaided.

Figure 4: A malleefowl working its mound (G Tonkin, 2015 ©)

Figure 3: A malleefowl mound (C. Taylor, 2005 ©)

If you think you have seen a malleefowl or a malleefowl mound, fill out a malleefowl report form (full or simple version) and send it to the Species and Communities Branch at fauna@dpaw.wa.gov.au.

Main threats to the malleefowl

- Habitat clearing for agriculture and mineral sand mining
- Vulnerability due to fragmentation and Isolation of remaining habitat
- Competition for food resources with introduced herbivores (sheep, rabbits, cattle, goats) and kangaroos
- Predation by introduced predators (foxes and cats)
- Increased frequency of wildfires and prescribed burning

Recovery Plan

Benshemesh, J. (2007). National Recovery Plan for Malleefowl *Leipoa ocellata*. Adelaide, South Australia: Department for Environment and Heritage.

The National Recovery Plan outlines actions that are being implemented to improve the conservation status of malleefowl populations:

- Protecting remaining malleefowl habitat through the establishment of conservation reserves and controlling vegetation clearing.
- Development of fire management plans
- Fencing of native vegetation remnants
- Revegetation to create links between patches of remnant habitat
- Introduced herbivore and predator control

- Monitoring programs and surveys of malleefowl and suitable habitat
- Establishment of education programs and community groups to raise awareness and gather data

Community Projects

The National Malleefowl Recovery Team, made up of farmers, scientists, community groups and government agencies, implements actions outlined in the National Malleefowl Recovery Plan. They also manage the National Malleefowl Monitoring Database, which is a great resource for mound monitoring data that has been annually collected by many individuals since the late 1980s. The Recovery Team is currently working with Melbourne University on the Malleefowl Adaptive Management Project.

Greening Australia, in partnership with Northern Agricultural Catchments Council, have launched a malleefowl-focused project in Western Australia as part of their national landscape restoration program called Restoring Native Vegetation to Enhance Malleefowl Neighbourhoods in the Yarra Yarra Catchment, Western Australia. They are working with local communities to strategically restore native vegetation on 300 ha of cleared farm land.

Yongergnow Australian Malleefowl Centre contributes to the conservation of malleefowl and their habitat through education and raising public awareness.

Acknowledgement is given to the community groups that dedicate their time and energy to the conservation of the malleefowl, and gather information on malleefowl including sighting data and monitoring records. The Nest Egg Foundation, formerly known as the Malleefowl Preservation Group collate sightings reported by volunteers and other community groups including North Central Malleefowl Preservation Group (NCMPG) and Friends of North Eastern Malleefowl (FONEM). These records form a significant part of the records available in Nature Map.

Great Victoria Desert Biodiversity Trust: Malleefowl Project

The objective of the Great Victoria Biodiversity Trust is to conserve and increase knowledge of biodiversity in the Great Victoria Desert (GVD). They are developing a Bioregional Plan for the GVD bioregions, facilitating Indigenous involvement in land management and conservation activities, and facilitating research and conservation management for threatened species.

Further information about the Trust and its activities can be found on their website.

The Department of Parks and Wildlife has been working with the Trust on developing a research and management plan for the malleefowl. On 25 November 2015, the Trust hosted a workshop where experts from industry, consultants, government agencies and environmental not-for-profit groups presented their latest research and discussed the challenges and priorities for the species. The workshop identified the need to collate malleefowl records in the GVD from a wide range of sources, which the Department is currently coordinating.

Read the Department's report on the Malleefowl Project.

Further Information

- Malleefowl (*Leipoa ocellata*) Species Profile and Fact Sheet (Department of Parks and Wildlife, 2016)
- EPBC Act SPRAT Profile – *Leipoa ocellata* Malleefowl
- *Survey guidelines for Australia's threatened birds: Guidelines for detecting birds listed as threatened under the EPBC Act* (Department of Environment, Water, Heritage and the Arts (DEWHA), 2010)
- The IUCN Red List of Threatened Species conservation assessment - Leipoa ocellata (Malleefowl)
- The Atlas of Living Australia and BirdLife Australia have information webpages about the species.
- The National Malleefowl Recovery Team implements the actions of the Recovery Plan. Their website has photos, facts and news about the species as well as links to their National Malleefowl Monitoring Database.

Appendix 9: Draft Species Facts Sheets

Species fact sheets will be finalised pending final endorsement, and will be updated as required and as new information becomes available.

Department of Parks and Wildlife

Fauna profiles

Get to know Western Australia's fauna

Malleefowl *Leipoa ocellata*

Conservation Status: Vulnerable

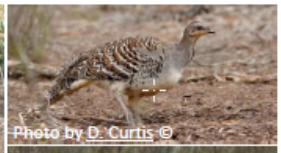
Identification

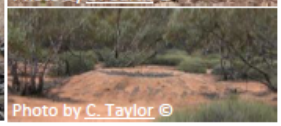
Malleefowl (*Leipoa ocellata*) are large, ground-dwelling birds that rarely fly unless alarmed. They are one of three mound building bird species in Australia, and the only one in Western Australia. They are approximately the size of a domestic chicken, with adults weighing between 1.5 and 2.5kg. They have robust, powerful legs and the wings are short, broad and rounded at the tip.

Malleefowl can be very hard to spot because they camouflage so well with their natural environment. They are characterised by the distinct grey, black and white banding across their body and wings. The breast and belly are cream-white, and their neck and head are greyish with a white stripe under the eye. A dark crest extends from the front of the crown to the nape and is raised when the bird is alarmed. Both sexes are similar in appearance; however males are slightly larger than females.

Taxonomy

Family: Megapodiidae
Genus: *Leipoa*
Species: *ocellata*
Other common names: gnow, mallee hen, native pheasant, lowan, nganamara, incubator bird, thermometer bird





Distribution and Habitat

Historically, malleefowl were found in the semi-arid mallee shrublands and woodlands across southern Australia in New South Wales, Victoria, South Australia, Northern Territory and Western Australia. Though the species is still found across their range, there has been local extinctions in the NT, northern SA and far south-west WA, and it remaining populations are highly fragmented due to extensive land clearing.

In Western Australia, malleefowl continue to persist in in several nature reserves across the state including Dryandra State Forest, Fitzgerald River National Park, Stirling Range National Park, Kalbarri National Park, Mount Manning – Helena and Aurora Ranges Conservation Park, , and have been reintroduced to Francois Peron National Park in Shark Bay. They are most commonly seen in reserves and private property within and around the Wheatbelt region. Recent surveys in the Goldfields have also noted that malleefowl continue to persist in this arid region.

Malleefowl are found in arid and semi-arid areas dominated by mallee eucalypts on sandy soils. They are known to also occur in Mulga (*Acacia aneura)*, Broombush (*Melaleuca uncinata*), Scrub Pine (*Callitris verrucosa*), eucalypt woodlands and coastal heathlands. Malleefowl require abundant leaf litter and a sandy substrate for the successful construction of nest mounds.

Community Involvement

If you think you have seen a Malleefowl or a Malleefowl mound, fill out a malleefowl report form and send it to the Department of Parks and Wildlife's Species and Communities Branch at fauna@dpaw.wa.gov.au. The Department keeps track of the distributions of threatened species to help monitor population trends and inform management decisions.

The Department runs a variety of volunteer projects across WA including scientific research, community education and manual labour. Further information about these opportunities can be found on the Department's webpage.

Biology and Behaviour

Malleefowl are typically quiet-moving and will often freeze or move quietly away when disturbed, but they are also known to burst up over trees with heavy flapping. The male malleefowl makes a deep, two-note bellowing or booming, or loud clucks. The female makes a high-pitched crowing, soft crooning or low grunting. Malleefowl are generalist feeders that have an omnivorous diet consisting of seeds, fruits, flower buds as well as invertebrates, lerps, tubers and fungi.

Birds tend to breed in the same area each year and so are generally sedentary, but radio-tracking studies have shown that over the course of a year the birds may range over one to several square kilometres. Birds do not appear to defend their home ranges despite considerable overlaps with other malleefowl.

Malleefowl pairs are generally monogamous and will pair for life once breeding begins. Breeding tends to occur once a year, with eggs laid from September until the end of summer. Malleefowl reach sexual maturity between 3 and 4 years of age. Malleefowl are considered to be long lived, with a known maximum lifespan of 28 years.

Malleefowl build distinctive nests comprised of a large mound of soil covering a central core of leaf litter that can span more than 5m in diameter and 1m in height. A malleefowl pair will often use the same nest site each breeding season rather than build a new one. Nest preparation occurs in autumn and the male will tend the nest throughout summer until temperatures begin to fall. The female helps with the nest initially but spends most of her time looking for food to meet the metabolic demands of egg production. Males do not stray far from the nest during breeding, and in the vicinity of the nest the male will act aggressively towards other malleefowl.

Clutch sizes are highly variable, ranging from 3-35 eggs with an average of approximately 15-25 eggs. The female will lay an egg in the mound every 5-7 days during the summer months. The decomposing organic matter with which the birds fill the nest incubates the eggs for approximately 60 days.

From November, chicks begin to hatch and emerge from within the mound unaided. About 80% of all eggs will hatch, provided they are not saturated by rain or predated by foxes or goannas. Chicks can often be buried up to one metre deep beneath the soil and may take up to 15 hours to emerge. They receive no parental care and within an hour of leaving the nest can run and feed independently. Chicks are capable of dispersing quite widely after emerging from the nest. However, mortality among chicks is high, with 80% of hatchlings killed by predators or dying from metabolic stress brought on by exposure or starvation within about ten days.

Conservation status

Malleefowl is recognised as a threatened species under State and Commonwealth legislation. In Western Australia the species is listed as Vulnerable on the *Wildlife Conservation (Specially Protected Fauna) Notice 2015*, based on an assessment using International Union for Conservation of Nature (IUCN) criteria. Nationally the species is listed as Vulnerable under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* and has been assigned the threat status of Vulnerable on the IUCN *Red List of Threatened Species*.

There are several threats currently impacting the survival of malleefowl populations, including:

- Ongoing habitat loss from vegetation clearing;
- Death and injury resulting from vehicle strike and fox and cat predation;
- Competition for food and habitat with introduced herbivores (sheep, rabbits, cattle, goats);
- Habitat degradation and loss from increased fire frequency;
- Climate change.

Management

Recovery Plan

A national recovery plan (Benshemesh, 2007) has been produced for this species, aiming to de-list the malleefowl as a threatened species under the EPBC Act. Management objectives from this plan include:

- Reduce permanent habitat degradation and loss due to gazing pressure, fire regimes and land clearing.
- Reduce mortality from predation and road mortalities.
- Reduce isolation of fragmented populations.
- Promote malleefowl-friendly agricultural practices.
- Increase public awareness and education.

Disclaimer

Citation

Western Australia. Department of Parks and Wildlife. (2016). *Fauna profiles: Malleefowl Leipoa ocellata* Retrieved from http://www.dpaw.wa.gov.au/

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Department of Parks and Wildlife

Fauna facts

Get to know Western Australia's fauna

Malleefowl *Leipoa ocellata*

What is it? Malleefowl are large ground-dwelling birds that rarely fly. They build large nests, called mounds, on the ground out of soil and leaf litter. It is one of three mound building bird species in Australia, and the only native one found in Western Australia.

Scientific Name: *Leipoa ocellata* **Other Common Names:** gnow, nganamara, incubator bird, thermometer hen

Why are they important? Malleefowl are considered a threatened species under state and Commonwealth law. This means the species is considered to be facing a high risk of extinction in the wild. Their survival is threatened by vegetation clearing, predation by foxes and cats, increased fire frequency, road mortality and competition with sheep, rabbits, cattle and goats.

Interesting Facts

- The scientific name means 'eyelet egg-leaver' because of the white ring around their eyes and the way they bury their eggs in the mound.
- Malleefowl use their beaks to check the temperature inside the mound.
- After the female has laid the eggs, the male stays nearby to take care of the eggs buried inside the nest.
- Each egg weighs about 10% of the female's body weight.
- Within a day of hatching, chicks can fly because their wings are already well feathered unlike their downy bodies.

What do they look and sound like?

Malleefowl can be very hard to spot because they camouflage so well with their natural environment. Their wing feathers have grey, black and white banding, their bellies are cream coloured, and the neck and head are greyish.

Malleefowl are typically quiet-moving and will often freeze or move quietly away when disturbed, but they are also known to burst up over trees with heavy flapping. The male malleefowl makes a deep bellowing or booming noise, or loud clucks, while the female makes a high-pitched crowing, soft crooning or low grunting noise.

A malleefowl working its mound (G Tonkin, 2015 ©)

Where are they found?

Malleefowl used to be found in arid and semi-arid Mallee (eucalyptus) shrublands and woodlands across southern Australia. Since European settlement, large areas of native vegetation have been cleared for farming, which has removed a lot of the habitat that malleefowl use. They are now found in only small patches, most of which are in national parks and nature reserves. In WA they are most commonly seen in the Wheatbelt region.

What are malleefowl mounds?

Malleefowl make their nests on the ground by heaping together a large mound of soil over a pile of leaves and sticks. A malleefowl pair will often use the same mound each breeding season instead of building a new one. The female lays up to 25 pale pink or brown eggs and buries them inside the nest. The male then tends to the mound, making sure the temperature inside the mound stays the same until the chicks hatch 7 weeks later.

If you think you have seen a malleefowl or a malleefowl mound, fill out a **malleefowl report form** (full or simple version) and send it to the Species and Communities Branch at fauna@dpaw.wa.gov.au.