Tropicana Gold Project

Officer Basin Desktop Assessment
Flora and Fauna
September 2008

Acacia denticulosa (www.wheatbelttourism.com)

Great Desert Skink (www.abc.net.au)

Executive Summary

360 Environmental Pty Ltd was commissioned by the Tropicana Joint Venture (TJV) to undertake a desktop assessment of miscellaneous leases held by the TJV. The leases are located within the Great Victoria Desert (GVD) Interim Biogeographic Regionalisation of Australia (IBRA) (Figure 1). The leases lie above the Officer Basin which is being considered as a groundwater resource for supply to the proposed Tropicana Gold Project (TGP).

A desktop assessment for flora, fauna and ecological communities of conservation concern was carried out for the leases and surrounding area (survey area). In addition, vegetation types, landforms and soil types were described for the survey area at a high level. These desktop studies were required to ensure environmental constraints were identified to enable the TJV to determine an appropriate water supply area for the proposed TGP.

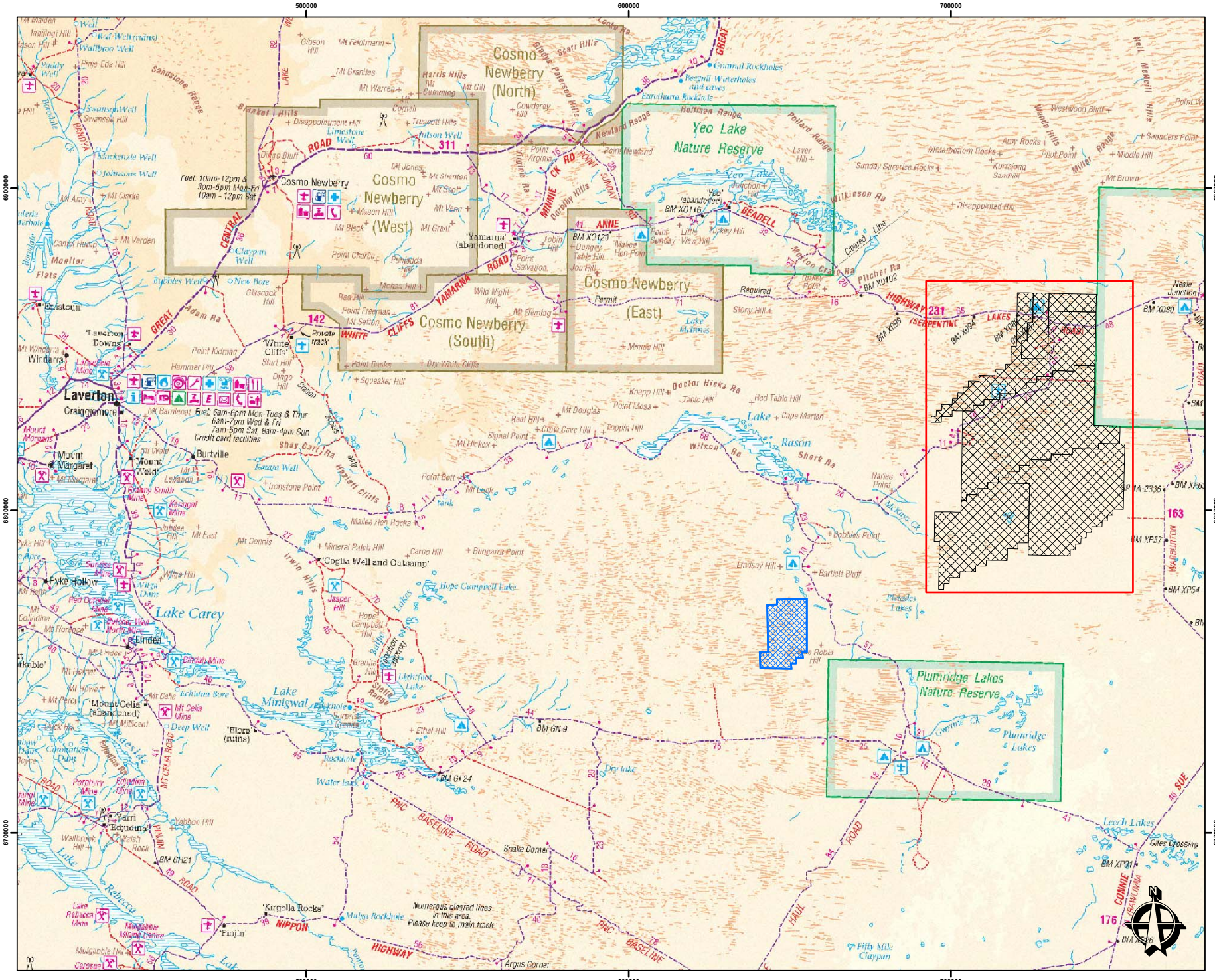
Findings of the assessment include:

- The major vegetation communities described by Beard (1975) that occur within the survey area are:
    - Hummock grassland
    - *Acacia* forests and woodlands
    - *Acacia* shrublands
    - *Casuarina* forests and woodlands
    - Chenopod shrublands, samphire shrubs and forblands
- Flora species of conservation concern that potentially occur within the survey area are:
    - *Acacia denticulosa* was identified as potentially occurring in the survey area. This species is considered Vulnerable under the *Environment Protection and Biodiversity Conservation Act* 1999 (EPBC Act) and is also considered as Declared Rare Flora (DRF) under the *Wildlife Conservation Act* 1950 (WC Act).
    - The weed species *Carrichtera annua* was identified by an EPBC Environmental Reporting Tool as potentially occurring in the survey area.
    - A further five Priority species as listed by the Department of Environment and Conservation (DEC) may occur within the survey area.
- Fauna species of conservation concern potentially occurring within the survey area include:
    - The Mulgara, Southern Marsupial Mole, Malleefowl, Slender-billed Thornbill, Rainbow Bee-eater, Cattle Egret, Oriental Plover, Princess Parrot and the Great Desert Skink have been identified by the EPBC Environmental Reporting Tool as potentially occurring within the survey area.
    - In addition, species protected under the WC Act or listed as Priority species by the DEC that have been recorded in the survey area (+ 50 km buffer) and include the Southern Marsupial Mole, Malleefowl, Peregrine Falcon, Major Mitchells' Cockatoo, Naretha Blue Bonnet, Grey Falcon, Australian Bustard, Princess Parrot, Striated Grasswren, Thick-billed Grasswren and the Crested Bellbird (DECThreatened Fauna Database).

- The DEC Threatened Ecological Communities (TEC) database indicates that no TECs or Priority Ecological Communities (PECs) have been recorded in the survey area.
- The survey area abuts the Neale Junction Nature Reserve and is situated on vacant crown land.
- There are no significant permanent water bodies within the survey area.

The main environmental constraints to the borefield and associated network under consideration include:

- Clearing impacts including loss of threatened taxa or their habitat.
- Introduction and/or spread of weeds.
- Introduction and/or spread of feral animal species to the area.
- Increased risk of anthropogenic fire.
- Spills of environmentally hazardous substances including hydrocarbons or hypersaline water.



Legend

- Miscellaneous Leases
- Project Area
- Survey Area

NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS
- AERIAL PHOTOGRAPHY SOURCED FROM LANDGATE 2007
- LOCALITY MAP SOURCED FROM WHEREIS 2008

SCALE

0 9,000 18,000 36,000 54,000

Metres

1:1,100,000 @ A3

LOCALITY MAP

COPYRIGHT

METADATA RECORDED	PROJECTION
100%	MGA ZONE 50
HORIZONTAL DATUM	**HEIGHT DATUM**
GDA 94	N/A

CREATED BY	CHECKED BY	APPROVED
GWa	BP	
DATE	**REVISION**	**DRAWING NO.**
04.09.08	0	351/2.02

Tropicana Joint Venture
TROPICANA GOLD PROJECT

Officer Basin Water Supply Area
Figure 1

Table of Contents

1 INTRODUCTION

360 Environmental Pty Ltd (360 Environmental) was commissioned by the Tropicana Joint Venture (TJV) to undertake a desktop assessment of miscellaneous leases located approximately 380 km east northeast of Kalgoorlie in Western Australia. The miscellaneous leases lie above the Officer Basin which is being considered as a groundwater resource for supply to the proposed Tropicana Gold Project (TGP). This desktop assessment considers the area in which the leases lie (survey area) in terms of environmental constraints that may be impacted by the development of the area for water supply. Limited sampling and surveys have been conducted in the area of the miscellaneous leases; this desktop assessment is therefore based on limited data.

2 BACKGROUND

The main components of the TGP are:

- Project Area: open pits, processing plant, village, ancillary buildings, reverse osmosis plant and other necessary infrastructure.
- Water Supply Area.
- Mine Access Road.

There are currently two potential water supply areas being considered by the TGP; the Minigwal Sub Basin and the Officer Basin. A borefield will be required to supply the TGP consisting of up to 30-production water bores generating up to 7 M m^3/annum with a total dissolved solids (TDS) ranging from 30,000 – 240,000 mg/L. The borefield will contain 60 – 120 km of buried pipelines that will transfer the water from either the Minigwal Sub Basin or the Officer Basin to the Project Area. It is likely that a low and a high saline pipeline network will be established within the same pipeline corridor to maximise the efficiency of water use. This assessment considers the terrestrial environment above the Officer Basin.

The purpose of this document is to assess the Officer Basin survey area by:

- Describing the regional setting.
- Identifying environmental constraints and present a preliminary indication of potential environmental impacts and management.

3 SCOPE OF WORKS

The following scope of work has been carried out and the results reported in this document are:

- Description of the survey area in a regional context incorporating major vegetation types, land forms, soil types and any unusual features of the survey area and surrounding region.
- Desktop search detailing any Declared Rare, Priority or other significant flora (Definitions - Appendix A).
- Desktop search for Threatened Ecological Communities (TECs) and Priority Ecological Communities (PECs).
- Desktop search for Threatened Fauna, Priority of other significant fauna (Definitions – Appendix B).

- No site visit was carried out, hence this desktop assessment does not meet all the criteria of a Level 1 Reconnaissance survey under the Environmental Protection Authority's (EPA) Guidance Statement No. 51 Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia (2004a) or Guidance Statement No. 56 Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia (2004b). However, the intent of this desktop assessment was to be a first-pass only; if the Officer Basin is selected by the TJV a physical survey should be arranged in the future.

4 METHODS

Regional information including climate, geology and soils, vegetation types, and landforms was sourced from current literature, web-based mapping tools and map-based information.

A search of conservation significant flora and fauna species, TECs and PECs potentially occurring within the survey area was performed using data from the Department of Environment and Conservation (DEC), the Museum of Western Australia (WAM) the Federal Department of the Environment, Water, Heritage and the Arts (DEWHA), various reference books (and local flora and fauna surveys within the Great Victoria Desert (GVD) Interim Biogeographic Regionalisation of Australia regions (IBRA).

All species of conservation concern recorded or expected to occur in the survey area were cross-checked against the Federal Environment Protection and Biodiversity Conservation (EPBC) Threatened Matters Database and Government Gazette Number 12 (Government of Western Australia 2008) for their status under the EPBC Act and WC Act, respectively.

5 REGIONAL SETTING

The survey area is located north east of Kalgoorlie and lies above the Officer Basin (Figure 1). The survey area is located in the GVD IBRA region.

5.1. CLIMATE

The climate of the GVD bioregion is arid, with mean annual rainfall ranging from below 150 mm to over 250 mm (Bureau of Meteorology 2008). The GVD does receive seasonal rainfall but shows significant variability between years. Temperatures can be extreme in the desert with large variations in diurnal temperatures, daily temperature ranges of 15 - 45 °C in summer and 0 - 30 °C during winter (Bureau of Meteorology 2008).

5.2. LANDFORMS

The GVD forms the southern part of the anti-clockwise whorl of dunefields of Australia. The dominating landforms are dunes and swales. There are local occurrences of playa lakes, associated lee-sided mounds (lunettes) and rocky prominences (Commonwealth Government 2008). Playa lakes are a minor, but locally significant landform in the desert, occurring in topographically low-lying regions and many represent the dried remnants of former drainage channels (Shephard 1995).

There are no water bodies located within the survey area.

5.2.1. OFFICER BASIN

The large intracratonic Neoproterozoic to Late Devonian Officer Basin of Western Australia and South Australia covers about 410,000 km^2 and has a maximum sediment thickness of 10,000 m (Geoscience Australia 2008).

The Officer Basin contains a sequence of sedimentary aquifers up to 400 m thick overlain by superficial sediments (Allen 1997). The main aquifers are the Permian Paterson Formation and the Devonian Lennis Sandstone (Allen 1997). The groundwater level in the Officer Basin is deep below the surface, ranging from 20 to 30 m below palaeodrainages, to as much as 100 m below the hills (Allen 1997). The salinity distribution is not well known. Some bores obtain fresh water, whereas elsewhere groundwater is brackish or saline (Allen 1997). Currently the basin is considered to contain a very large storage of brackish groundwater (Allen 1997).

5.3. GEOLOGY AND SOILS

The GVD bioregion consists of active sand-ridge desert of deep Quaternary (less than 65 million years ago) aeolian sands overlying Permian (251 – 298 million years ago) and Mesozoic (65 - 251 million years ago) units of the Officer Basin (Commonwealth Government 2008). The GVD is underlain on its eastern, western and northern margins by an ancient crystalline basement comprising rocks at least 1000 million years old (Shephard 1995).

The following major soil types described by Australian Geological Survey Organisation Geology Sheets (AGSO) (1995) occur within the survey area:

- Qs – Red quartz sand, longitudinal sand dunes and sand plains: aoelian.
- Czs – Sandplain deposits – unconsolidated yellow sand, minor silt and clay; includes stabilizing dunes.
- Czc – Colluvium – gravel, sand and silt as proximal sheetwash and talus; locally ferruginous.
- Czk -– Nodular and cavernous limestone and sandy limestone, minor chalcedony and clay: kankar.
- Pad – Dolomite, limestone, chert, partly stromatolitic: minor quartzite.
- Paf – coarse, poorly sorted sandstone, conglomerate, minor siltstone, dominantly fluviatile.
- Pag – Tillite, minor sandstone, siltstone, conglomerate; glacigene.

5.4. VEGETATION TYPES

The GVD is essentially a sandy region of sand dunes and sandplains with consistent vegetation throughout the range (Beard 1975). Vegetation is primarily a Tree steppe of *Eucalyptus gongylocarpa*, Mulga (*Acacia aneura*) and *E. youngiana* over hummock grassland dominated by *Triodia basedowii* (spinifex) on the aeolian sands (Barton and Cowan 2001).

The major vegetation communities described by Beard (1975) occur within both survey areas and include:

- Hummock grassland
- *Acacia* forests and woodlands
- *Acacia* shrublands
- *Casuarina* forests and woodlands
- Chenopod shrublands, samphire shrubs and forblands

5.5. LAND TENURE AND USE

The majority of the land in which the survey area lies is vacant crown land. The survey area abuts the Neale Junction Nature Reserve.

The wider GVD bioregion includes land holdings of the Arangu Pitjantjatjara and part of the Maralinga Tjarutja lands.

6 FLORA OF CONSERVATION CONCERN

No species of conservation concern have been recorded from the survey area based on searches of the DEC Declared Rare and Priority Flora Database, the WA Herbarium database and the EPBC Protected Matters database. Six species of conservation concern have been identified as occurring in the general vicinity of the survey area (Table 1).

The lack of threatened flora species is likely to be an artefact of limited sampling in the area, rather than a true lack of threatened species and limited diversity in the area.

Table 1: Flora species of conservation concern potentially occurring within the Survey Area.

Flora Species	Protected Under:		
Species Name	**EPBC Act 1999**	**WC Act 1950**	**DEC Priority**
Acacia denticulosa	Vulnerable	DRF	
Acacia eremophila var. numerous nerved variant			3
Calytrix warburtonensis			2
Eremophila undulata			2
Olearia arida			2
Thryptomene nealensis			3

For each species of concern the following section provides the distribution, preferred habitat or substrate and a brief description.

6.1. *ACACIA DENTICULOSA*

Species Information

Acacia denticulosa is an erect, diffuse, spindly shrub that grows between 1 and 4 m. Flowers are yellow, flowering occurs September–October (Plate 1).

Distribution

A. denticulosa is known from the Coolgardie, Avon Wheatbelt and Swan Coastal Plain regions (Figure 2). This species has been recorded in the Neale Junction Reserve since the WA Herbarium last updated the distribution map for *A. Denticulosa.*

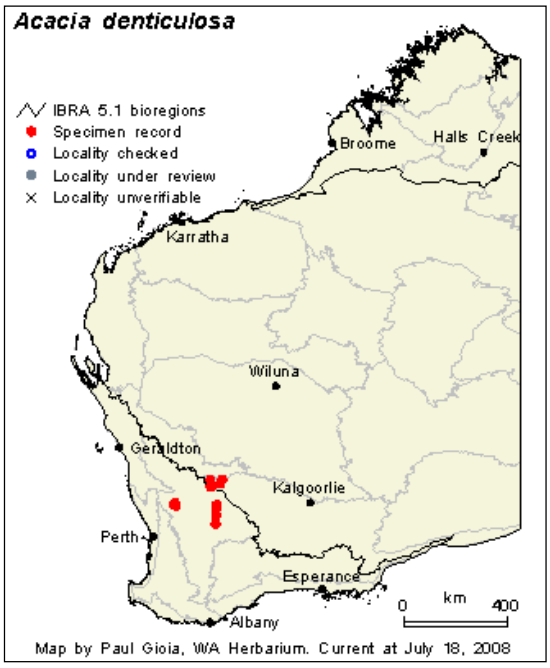


Figure 2: Distribution map for *A. Denticulosa* (http://florabase.calm.wa.gov.au/)
Note that the species has been identified in the Neale Junction Nature Reserve since the production of this map by the WA Herbarium.

Preferred Substrate

The preferred substrate of *A. denticulosa* is sand, loam, and clay. This species is found on granite outcrops and rarely on sandplains.

Conservation Status

A. denticulosa is considered to be of conservation concern to the TJV as it is listed under State and Federal legislation:

- EPBC Act - Vulnerable
- WC Act – Declared Rare Flora.

Plate 1 : *Acacia denticulosa* (http://florabase.calm.wa.gov.au/)

6.2. *ACACIA EREMOPHILA VAR. NUMEROUS-NERVED*

Species Information

Acacia eremophila var. numerous-nerved is a dense spreading shrub that grows between 1 and 2 m in height (Plate 2). The flowers are yellow and flowering is in September.

Distribution

A. eremophila var. numerous-nerved is known from the GVD, Coolgardie, Nullarbor and Murchison IBRA regions (Figure 3).

Preferred Substrate

The preferred substrate of *A. eremophila* var. numerous-nerved is sandy soils and flats.

Conservation Status

A. eremophila var. numerous-nerved is considered to be of conservation concern to the TJV as it is considered by the DEC to be a Priority species:

- Priority 3 - Poorly Known Taxa.

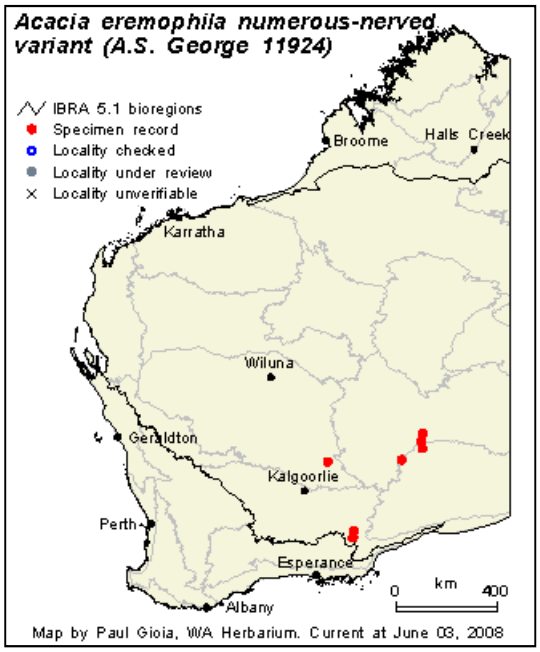


Figure 3: Distribution map for *Acacia eremophila* var. numerous-nerved (http://florabase.calm.wa.gov.au/)

Plate 2: *Acacia eremophila* var. numerous-nerved (WA Herbarium)

6.3. *CALYTRIX WARBURTONENSIS*

Species Information

Calytrix warburtonensis is a shrub and it grows between 0.3 and 0.6 m. Flowers are white, flowering occurs March –October (Plate 3).

Distribution

C. warburtonensis is known from the GVD, Gibson Desert, and the Murchison IBRA regions (Figure 4).

Preferred Substrate

The preferred substrate of *C. warburtonensis* is rocky hills and breakaways.

Conservation Status

C. warburtonensis is considered to be of conservation concern to the TJV as it is considered by the DEC to be a Priority species:

- Priority 2 - Poorly Known Taxa.

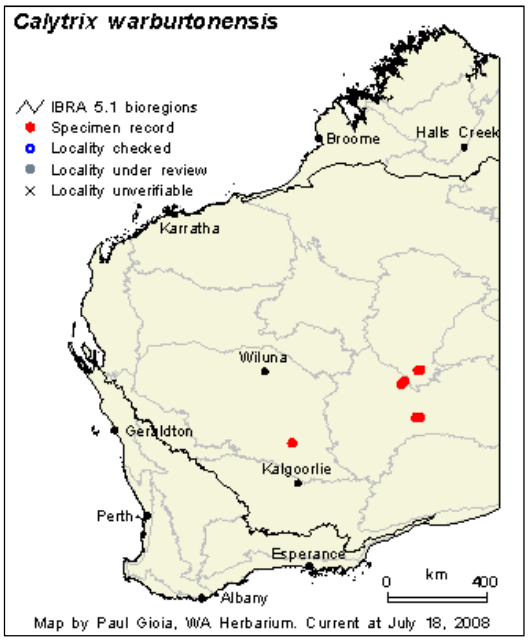


Figure 4: Distribution map for *Calytrix warburtonensis* (http://florabase.calm.wa.gov.au/)

Plate 3: *Calytrix warburtonensis* (http://florabase.calm.wa.gov.au/)

6.4. *EREMOPHILA UNDULATA*

Species Information

Eremophila undulata is a small shrub that grows to 0.5 m high and 1 m wide (Plate 4). Flowers are green brown, and yellow. Flowering occurs July – September.

Distribution

E. undulata is known from the GVD and Nullabor IBRA regions (Figure 5).

Preferred Substrate

The preferred substrate of *E. undulata* is red-brown clay loam and sand.

Conservation Status

E. undulata is considered to be of conservation concern to the TJV as it is considered by the DEC to be a Priority species:

- Priority 2 - Poorly Known Taxa.

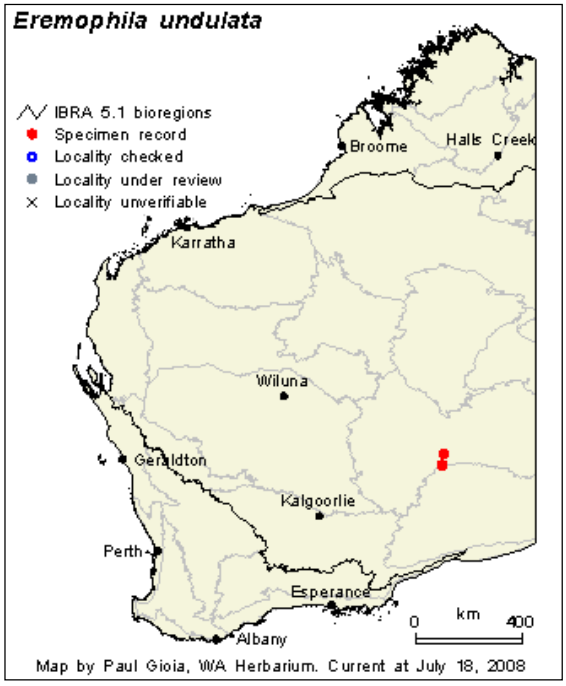


Figure 5: Distribution map for *Eremophila undulata* (http://florabase.calm.wa.gov.au/)

Plate 4: *Eremophila undulata* (http://florabase.calm.wa.gov.au/)

6.5. *OLEARIA ARIDA*

Species Information

Olearia arida is an erect shrub that grows to 0.4 m. Flowers are white and flowering occurs July – September. (Plate 5).

Distribution

O. arida is known from the GVD IBRA region (Figure 6).

Preferred Substrate

The preferred substrate of *O. arida* is red or yellow sand and undulating low rises.

Conservation Status

O. arida is considered to be of conservation concern to the TJV as it is considered by the DEC to be a Priority species:

- Priority 2 - Poorly Known Taxa.

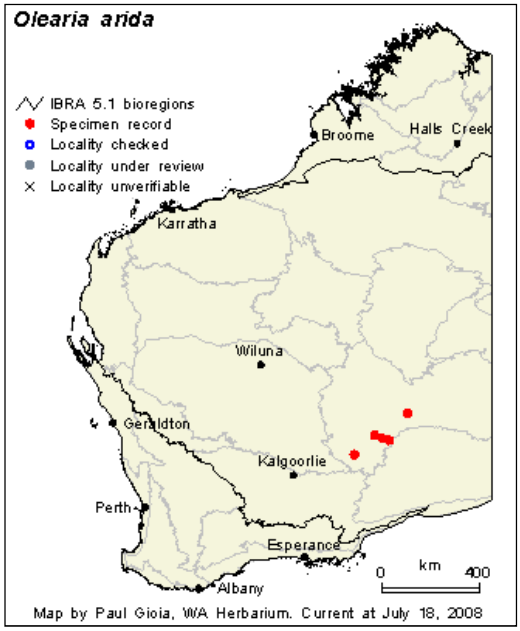


Figure 6: Distribution map for *Olearia arida* (http://florabase.calm.wa.gov.au/)

Plate 5: *Olearia arida* (http://botany.cs.tamu.edu/FLORA/perdeck/ire_413.jpg)

6.6. *THRYPTOMENE NEALENSIS*

Species Information

Thryptomene nealensis is a shrub that grows to 0.3 m. Flowers are pink and flowering occurs in October (Plate 6).

Distribution

T. nealensis is known from the GVD IBRA region (Figure 7).

Preferred Substrate

The preferred substrate of *T. nealensis* is lateritic breakaways.

Conservation Status

T. nealensis is considered to be of conservation concern to the TJV as it is considered by the DEC as:

- Priority 3 - Poorly Known Taxa.

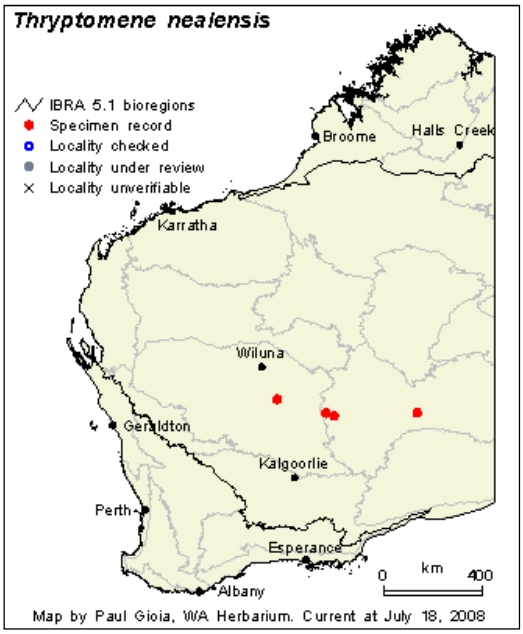


Figure 7: Distribution map for *Thryptomene nealensis* (http://florabase.calm.wa.gov.au/)

Plate 6: *Thryptomene nealensis* (WA Herbarium)

6.7. *CARRICHTERA ANNUA* - *WARDS WEED*

Species Information

Carrichtera annua is an erect annual herb that grows between 0.05 and 0.4 m. The flowers are white and flowering occurs September-November (Plate 7).

Distribution

Carrichtera annua is known from the Coolgardie, Hampton, Murchison, Nullarbor, Swan Coastal Plain, Avon Wheatbelt, Esperance and the Mallee IBRA regions (Figure 8).

Preferred Substrate

The preferred substrate of *C. annua* is dry open and disturbed sites, grassland, shrubland and heathland.

Conservation Status

C. annua is considered to be of conservation concern to the TJV as it is considered an invasive weed.

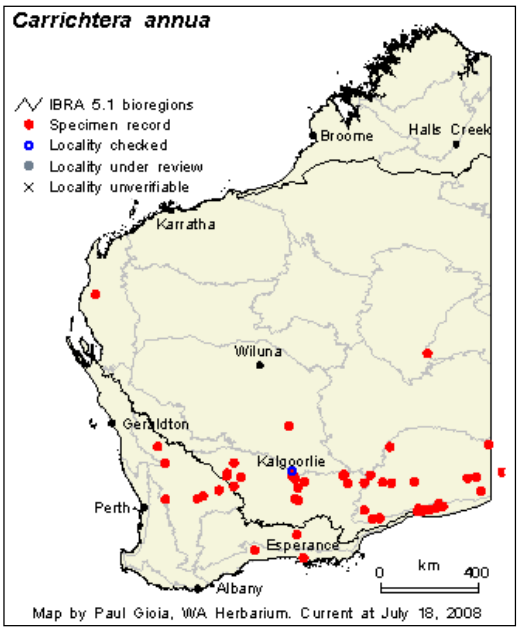


Figure 8: Distribution map for (http://florabase.calm.wa.gov.au/)

Plate 7: (http://members.iinet.net.au/~weeds/western_weeds/plant_images)

7 FAUNA OF CONSERVATION CONCERN

A search of the DECs Threatened and Priority Fauna Database, the Museum's Faunabase, the EPBC Protected Matters database and regional sources was undertaken to identify fauna species of conservation concern that potentially occur within the survey area (Table 2).

The DEC and Faunabase searches did not identify any species of conservation concern within the survey area consequently a 50 km buffer was included in the search to demonstrate species potentially occurring in the area.

Table 2: Fauna species of conservation concern potentially occurring within the Survey Area.

Fauna Species		Protected Under:			
Common Name	**Species Name**	**EPBC Act 1999**	**WC Act 1950**	**DEC Priority**	**IUCN**
Mammals					
Mulgara	*Dasycercus cristicauda*	Vulnerable	Schedule 1		Vulnerable
Southern Marsupial Mole	*Notoryctes typhlops*	Endangered	Schedule 1		Endangered
Birds					
Australian Bustard	*Ardeotis australis*			P4	Near Threatened
Cattle Egret	*Ardea ibis*	Migratory			Least Concern
Crested Bellbird (Southern)	*Oreoica gutturalis gutturalis*			P4	
Grey Falcon	*Falco hypoleucos*			P4	Near threatened
Major Mitchell's Cockatoo	*Cacatua leadbeateri*		Schedule 4		Least Concern
Malleefowl	*Leipoa ocellata*	Vulnerable	Schedule 1		Vulnerable
Naretha Blue Bonnet	*Northiella haematogaster narethae*		Schedule 4		
Oriental Plover, Oriental Dotterel	*Charadrius veredus*	Migratory			Least Concern
Peregrine Falcon	*Falco peregrinus*		Schedule 4		Least Concern
Princess Parrot, Alexandra's Parrot	*Polytelis alexandrae*	Vulnerable	Schedule 1		Near Threatened
Rainbow Bee-eater	*Merops ornatus*	Migratory			Least Concern
Slender-billed Thornbill (western)	*Acanthiza iredalei iredalei*	Vulnerable	Schedule 1		Least Concern

Fauna Species				Protected Under:	
Striated Grass wren	*Amytornis striatus striatus*			P4	
Thick-billed Grass-wren (western ssp)	*Amytornis textilis textilis*			P4	
Reptiles					
Great Desert Skink, Tjakura, Warrarna, Mulyamiji	*Egernia kintorei*	Vulnerable	Schedule 1		Vulnerable

For each species of concern the following section provides the distribution, preferred habitat or substrate and a brief description. Note that many of the species protected under the WC Act and the Priority species were recorded in the Neale Junction Nature Reserve and Plumridge Lakes Nature Reserve.

7.1. MULGARA - DASYCERCUS CRISTICAUDA

SPECIES INFORMATION

There has been considerable taxonomic confusion and re-sorting of the Mulgaras. For most of the last 30 years only one species, *D. cristicauda,* was recognised. However, Woolley (2005) re-assigned the species to the brush-tailed mulgara *D. blythi* and crest-tailed mulgara *D. cristicauda*. Both species have a wide geographic range in the arid zone of Australia, and overlapping distributions. Of the two species, *D. cristicauda* is the most likely species to be recorded within either survey areas.

The species can be distinguished by the form of the tail, the number of upper premolar teeth in each jaw and, in the female, by the number of nipples in the pouch (Woolley 2005). *D. cristicauda* has a crested tail (Plate 8), three upper premolars and eight nipples (Woolley 2005). *Dasycercus blythi* has a non-crested tail (Plate 9), two upper premolars and six nipples.

Plate 8: Tail of *D. cristicauda* (Woolley 2005)

Plate 9: Tail of *D. blythi* (Woolley 2005)

The Mulgara is a carnivorous marsupial that lives in the deserts of central Australia. *D. cristicauda* is roughly 12-22 cm long and 130 g with a 7-13 cm tail with sand coloured fur on the back fading to pale grey on the underbelly and chin (Woolley 2002) (Plate 10). The first half of the tail has the same colouration as the body; the second half of the tail bears a dorsal crest (Woolley 2005).

The Mulgara is a nocturnal and burrowing marsupial which digs on the flats between low sand-dunes or the slopes of high dunes (Woolley 2002). The Mulgara burrows are usually in the flat areas between sand dunes or on the lower margins of the dunes. The Mulgara burrows can often be found in groups. Burrows can vary in complexity from burrows with single-entrance holes and minimal tunnelling to multi-entrance holes with deep and complex tunnels and branches. Complex burrows will also often have numerous 'pop' holes for alternative access and observation points. Mulgara will retreat into their burrows to escape the heat of the day, particularly in summer, although they have been observed to bask in the sun during winter.

The Mulgara tend to maintain a permanent home rather than migrating to follow food sources, so a permanent cover of spinifex is important, not only to provide refuge, but also to provide habitat for prey species and cover to move around and hunt. Even when rainfall is low, Mulgara tend not to migrate and population size is regulated by the presence of adequate water and food resources. The diet of the Mulgara includes insects, other arthropods and small vertebrates (Woolley 2002).

Little is known regarding breeding in the wild but females with up to eight young have been captured between June and December (Woolley 2002). The breeding season occurs from June through December (Woolley 2002).

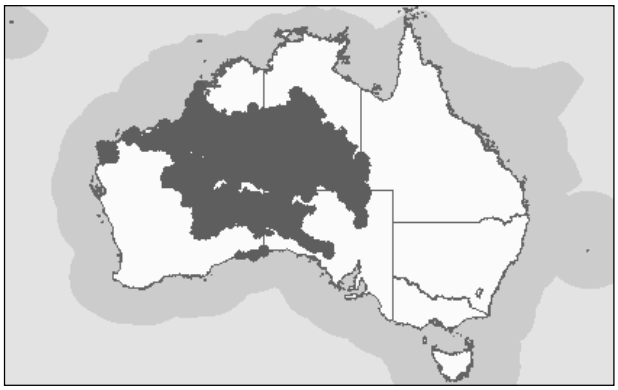


Figure 9: Distribution Map of the Mulgara (http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=328)

Plate 10: The Mulgara, *Dasycercus cristicauda* (Northern Territory Government 2008)

DISTRIBUTION

Because most previous records did not distinguish among the two species of mulgara now recognised, there is ambiguity about the distribution of both species.

D. cristicauda has a patchy but widespread distribution in sandy regions of arid central Australia and Western Australia (Figure 9) (Menkhorst and Knight 2004). Although the range of the mulgaras is large, the density across that area is low, with local communities inhabiting the spinifex clumps across the arid sandy region. The main populations appear to be found in the Northern Territory and Western Australia at present, with the main presence being in the Pilbara, Tanami Desert and Great Sandy Desert.

The distribution of the Mulgara at any one time appears to be affected by local rainfall which affects the availability of food resources. However, predation by introduced animals such as Wild Dogs, Feral Cats and European Foxes along with the encroachment on available habitat by anthropogenic activities are likely to have also had an effect.

PREFERRED HABITAT

The main vegetation in inhabited areas, specifically *Triodia basedowii*, provides refuge from the heat and cover for the entrance to their burrows. As noted above, Mulgara live in burrows which they dig on the flats between low sand-dunes or on the lower edges of dunes (Woolley 2002).

CONSERVATION STATUS

D. cristicauda is considered to be of conservation concern for the TJV as it is listed under State and Federal legislation:

- WC Act 1950 – Schedule 1 - Fauna that is likely to become extinct
- EPBC Act – Vulnerable.

It is also listed by the IUCN as Vulnerable.

7.2. SOUTHERN MARSUPIAL MOLE - NOTORYCTES TYPHLOPS

SPECIES INFORMATION

Marsupial Moles comprise their own order within the marsupials; the Notoryctemorphia (Benshemesh 2004). Recent genetic and morphological analyses suggest that there are three distinct lineages of marsupial moles: *Notoryctes caurinus* (Northern Marsupial Mole) and *N. typhlops* (Southern Marsupial Mole: northern and southern forms) (Benshemesh 2004). The distribution of these lineages are undetermined however it appears that they occupy broadly different areas (Benshemesh 2004).

The SMM (Southern Marsupial Mole) is a small animal (30 - 60 g) that is adapted to digging and a life underground (Johnson 2002) (Plate 11). Little is known regarding the cryptic SMM. They occur in remote areas, are morphologically specialised and exhibit extraordinary features. The SMM has a distinct tubular body shape, lacks external ears, and has heavily keratinised skin on the snout, a reduced tail and short dense fur (Johnson 2002). The limbs of the SMM are adapted to burrowing, being short and powerful and bear large triangular claws forming a cleft-like spade (Johnson 2002). As with other burrowing marsupials, the pouch of the SMM opens backwards (Benshemesh 2004).

Little is known regarding the habitat preference for the SMM. They are most often recorded in arid regions in sand dune area associated with various *Acacia* sp. and shrubs (Benshemesh 2004). It has been suggested that they require soft sand and are unable to tunnel through hard or loamy substrate, which often occur in swales between widely spaced dunes (Benshemesh 2004). There is evidence that SMM do occur in substrate between the dunes where deep sand rather than loam occurs. The SMM may also occur in sandy plains. Marsupial mole tunnels have been found in association with patches of mallee (*Eucalyptus gamophylla*) with an open under storey of spinifex (*Triodia basedowii*) (Benshemesh 2004). The TJV has also recorded evidence of the marsupial mole in association with *Callitris verrucosa* and Marble Gum (*E. gongylocarp*).

SMM are insectivorous, existing on predatory ants, seed-eating ants, termites and other arthropods (Johnson 2002). Additional food of the SMM includes the eggs, larvae and pupae of various species, including beetles, moths, ants and sawflies captured underground (Johnson 2002).

Little is known about the reproduction cycle of the SMM (Johnson 2002). The breeding season is believed to be November when one or two young are born and these are nursed in the pouch (Benshemesh 2004). It is believed they are solitary for most of their life, how they find reproductive partners is unclear (Benshemesh 2004).

The SMM spends the majority of its time burrowing and backfilling through sand, but it is not known whether they build a nest or form permanent burrows (Benshemesh 2004). They leave no open tunnel, just the circular trace of its passage approximately 30 – 40 cm below the surface (small, circular impression visible in a soil profile) (Benshemesh 2004). The SMM is believed to come to the surface briefly, most often after rain and in the cooler seasons (Johnson 2002; Pearson & Turner 2000) or to move between dunes where the swale substrate is inhospitable (Benshemesh 2004). While on the surface, the SMM is probably most susceptible to predation.

DISTRIBUTION

The SMM is known to occur in the sandy deserts of central and eastern WA, northern SA and the NT (Figure 10) (Johnson 2002; Pearson and Turner 2000; Benshemesh 2004). The species range appears to be restricted to sandy soils in the central desert region encompassing the Great Sandy, Little Sandy, Gibson, Tanami, Great Victoria and western Simpson Deserts. Unfortunately, much of the distribution information is based on sighting information where the animal was not identified to species level, thus this distribution may incorporate sighting records of the Northern Marsupial Mole.

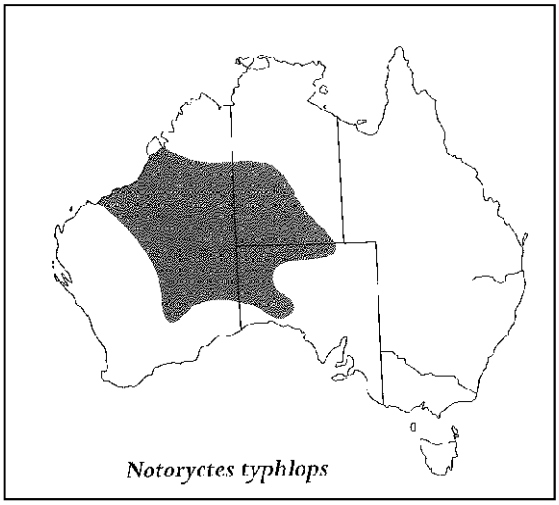


Figure 10: Distribution map of Southern Marsupial Mole (www.environment.gov.au/cgi-bin/sprat/public/sprat.pl)

Plate 11: The Southern Marsupial Mole, *Notoryctes typhlops* (*ecologia* Environment 2007)

PREFERRED HABITAT

SMM inhabits spinifex dominated sand dune and sand plain country. The sand in these regions tends to be loose and free of gravels. The SMM appears to have a preference for substrate with compactness at the level of <10 drops per 150 mm to a depth of at least 450 mm when measured using a penetrometers (*ecologia* Environment 2007).

CONSERVATION STATUS

The SMM is considered to be of conservation concern to the TJV as it is listed under State and Federal legislation:

- WC Act – Schedule 1 - Fauna that is likely to become extinct
- EPBC Act – Endangered.

They are considered to be Endangered by the IUCN.

7.3. AUSTRALIAN BUSTARD - ARDEOTIS AUSTRALIS

SPECIES INFORMATION

The Australian Bustard is an upstanding large bird of the open country. Bustards weigh 14 kg, stand 120 cm tall with a wingspan of around 2 m (Plate 12). They have a pale grey neck and belly, and freckled brown wings and tail; males have a black crown, females blue (Pizzey & Knight 2002).

Bustards breed from August-November in Southern Australia (Pizzey & Knight 2002). They usually lay one egg directly on the ground, typically along a boundary between open grasslands and more protective shrubland or woodlands. Bustards are unique among Australia's birds in that they exhibit what is known as an 'exploded lek' mating system. Leks are tight aggregations of males that come together to display in specific areas, in order to attract females. They appear to move nomadically in response to local variations in the supply of their preferred diet of insects, small vertebrates, seeds and fruit.

DISTRIBUTION

The Australian Bustard was once widespread on mainland Australia, however the species has suffered historic decline, and now they are rarely recorded in south eastern Australia (Figure 11). They are still common away from settlements in parts of eastern inland, inland northern Australia and WA (Pizzey & Knight 2002).

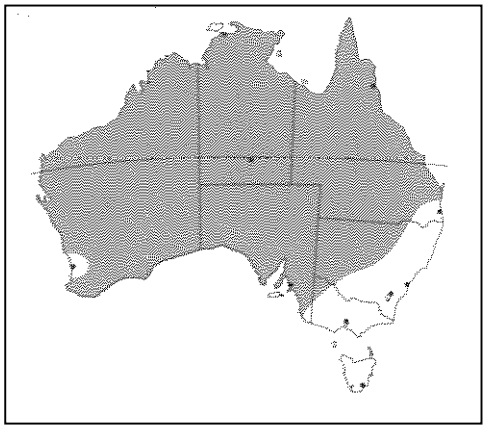


Figure 11: Distribution map of the Australian Bustard (Pizzey & Knight 2002)

Plate 12: The Australian Bustard, *Ardeotis australis* (www.australianwildlife.org/)

PREFERRED HABITAT

Australian Bustards are found in tussock grassland, *Triodia* hummock grassland, grassy woodland, low shrublands. They will also use denser vegetation when recent burning has temporarily opened up these areas.

CONSERVATION STATUS

The Australian Bustard is not listed under State or Federal legislation. The IUCN categorises the Bustard as 'Near threatened', and it is considered to be Priority 4 (Taxa in need of monitoring) by the DEC.

7.4. CRESTED BELLBIRD - OREOICA GUTTURALIS GUTTURALIS (SOUTHERN)

SPECIES INFORMATION

The Crested Bellbird is a medium-sized bird. Adult males have grey heads with a raised black crest, a white forehead and throat, and a prominent black breast (Plate 13) (Simpson and Day 1998). The rest of the body is grey or brown and they have orange-red eyes (Simpson and Day 1998). Females and immature birds are less prominently coloured than the males, lacking the black breast and having a smaller, unraised black crest (Simpson and Day 1998).

The Crested Bellbird feeds on invertebrates and some seeds. They forage on the ground or in low shrubs. They are usually solitary or occur in pairs during the breeding season.

DISTRIBUTION

The species has contracted towards the inland in south-western Australia, South Australia, Victoria, New South Wales and Queensland (Figure 12) (Garnett and Crowley 2000).

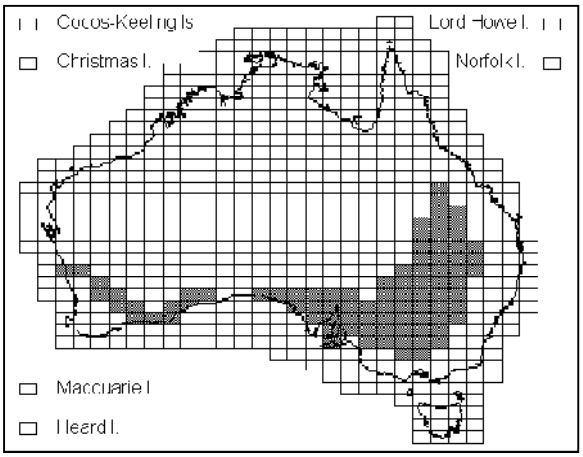


Figure 12: Distribution map of the Crested Bellbird (Garnett and Crowley 2000)

Plate 13: The Crested Bellbird (Southern) *Oreoica gutturalis gutturalis.* (www.graemechapman.com.au/cgi-bin/viewphotos.php?c=10)

PREFERRED HABITAT

This sedentary and solitary species inhabits the drier mallee woodlands and heaths of the southern parts of the State. Crested Bellbirds live in the shrub-layer of eucalypt woodland, mallee, acacia shrubland, *Triodia* hummock grassland, saltbush and heath, where they feed on a variety of insects and seeds (Garnett and Crowley 2000). A clutch of 2-4 eggs is laid in a cup nest (Garnett and Crowley 2000).

CONSERVATION STATUS

The Crested Bellbird is considered to be of conservation concern to the TJV as it is listed under State legislation as Priority 4 – Taxa in need of monitoring.

7.5. GREY FALCON - FALCO HYPOLEUCOS

SPECIES INFORMATION

The Grey Falcon is one of Australia's rarest raptors (Government of South Australia 2007). The Grey Falcon is a medium-sized, compact, pale falcon with a heavy, thick-set, deep-chested appearance (Pizzey & Knight 2002) (Plate 14). Upperparts are uniform light grey, shading to blackish on the primaries, forming conspicuous dark wing tips. The tail has narrow blackish bars (Pizzey & Knight 2002). The chin, throat and cheeks are white, and the rest of the underbody is pale grey (Pizzey & Knight 2002). The eye-ring, cere and base of the bill are bright orange-yellow, and the tip of the bill black. They are generally 30-44 cm with a wing span of 90 cm (Pizzey & Knight 2002).

Like other falcons it utilises old nests of other birds of prey and ravens, usually high in a living eucalypt near water or a watercourse. Peak laying season is in late winter and early spring when two or three eggs are laid (Government of South Australia 2007). The prey of the Grey Falcon is primarily birds, especially parrots and pigeons. Reptiles and mammals are also taken using high-speed chases and swoops (Government of South Australia 2007). Its hunting flight is low, direct and swift, and flushed birds are pursued with deep strong wingbeats.

DISTRIBUTION

The Grey Falcon is an Australian endemic, usually confined to the arid inland (Figure 13) (Government of South Australia 2007). They are considered to be resident or nomadic visitors to inland parts of all mainland states.

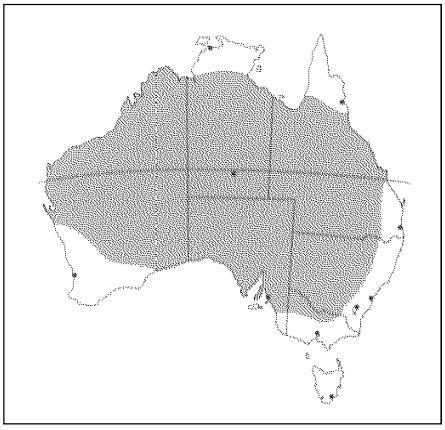


Figure 13: Distribution map of the Grey Falcon (Pizzey & Knight 2002)

Plate 14: The Grey Falcon, *Falco hypoleucos* (www.saalnrm.sa.gov.au/)

PREFERRED HABITAT

The Grey Falcon is usually restricted to shrubland, grassland and wooded watercourses of arid and semi-arid regions, although it is occasionally found in open woodlands near the coast (Government of New South Wales 2007). They also occur near wetlands where the surface water attracts the prey (Government of New South Wales 2007).

CONSERVATION STATUS

The Grey Falcon is not listed under Federal legislation. The Grey Falcon is considered to be of conservation concern to the TJV as it is considered by the DEC to be a Priority 4 species. The IUCN consider the Grey Falcon to be 'Near threatened'.

7.6. MAJOR MITCHELLS COCKATOO – CACATUA LEADBEATERI

SPECIES INFORMATION

The length of the Major Mitchell is approximately 35 cm and the weight approximately 350-400 g. The upperparts are white, the face, neck, underwings are underparts are pink (Plate 15). The species has a long crest, bright red and yellow bands (Simpson and Day 1998).

Major Mitchell's are rarely reported in large numbers most often seen throughout their range in pairs or small groups. Adult pairs mate for life, and occupy permanent breeding territories The Major Mitchell's forages on the ground for grass seeds, fruits, nuts, berries, and roots (Queensland EPA 2007)). Major Mitchell's cockatoo nesting pairs need a large feeding area surrounding the nest, so nests of adjacent pairs are well separated (Queensland EPA 2007).

Nesting occurs from July to January inclusive. Nests are located in the hollows of eucalypts or dead *Callitris* spp., where usually three to four eggs are laid. The young leave the nest when they are about eight weeks old. Pairs on average raise less than two young per season (Queensland EPA 2007).

DISTRIBUTION

Major Mitchell inhabits the wooded grasslands of Inland Australia (Simpson and Day 1998). The species is known to have declined in the eastern and southern parts of its range (Queensland EPA 2007). It is found from central New South Wales and south west Queensland to southern and northern inland Western Australia (Figure 14) (Queensland EPA 2007).

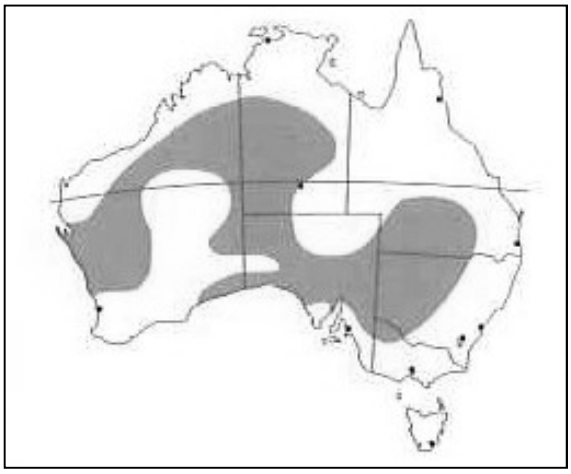


Figure 14: Distribution map of the major Mitchells Cockatoo (Pizzey and Knight 2002)

Plate 15: The Major Mitchells Cockatoo, *Cacatua leadbeater* (www.google.com.au/imgres?imgurl=http://lh3.google.com)

PREFERRED HABITAT

The Major Mitchell's Cockatoo inhabits a wide variety of semi-arid and arid inland habitats, provided there is fresh surface water and large hollow trees for nesting (Queensland EPA 2007). It has been recorded in forest, woodland and shrubland, including mulga, mallee*, Acacia*, and *Callitris* associations. It has also been recorded in cropping areas throughout its range (Queensland EPA 2007).

CONSERVATION STATUS

The Major Mitchells Cockatoo is considered to be of conservation concern to the TJV as it is listed under State legislation as Schedule 4 – Other specially protected fauna.

7.7. MALLEEFOWL – LEIPOA OCELLATA

SPECIES INFORMATION

The Malleefowl is a large and distinctive ground-dwelling bird that grows up to 60 cm in length and can weigh up to 2.5 kg (Pizzey & Knight 2002) (Plate 16). The Malleefowl is a mainly terrestrial species; it rarely flies, preferring to walk slowly across the terrain.

The Malleefowl is a generalist forager. It feeds mainly on seeds, but also takes other plant material (mostly flowers, fruits and foliage), invertebrates (mainly insects including ants, beetles and cockroaches), lerp (a sugary substance secreted by psyllid insects), fungi and tubers. They peck food items from the ground and from low vegetation (mostly herbs and shrubs) and use their feet to search among leaf-litter and to scratch at the soil to expose tubers and invertebrates.

Adult Malleefowl usually occur singly when away from their breeding mounds, and in pairs when present at active mounds (Plate 17) (Benshemesh 1999). They breed in solitary pairs.

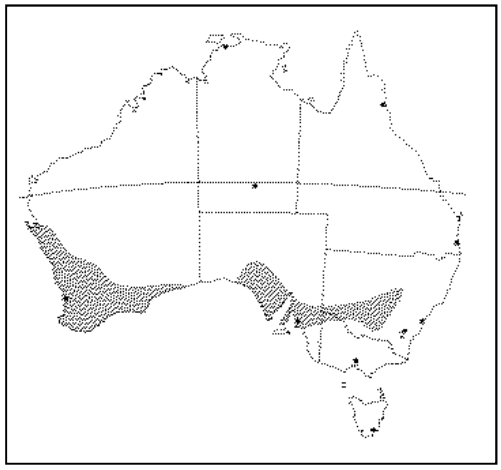


Figure 15: Distribution map of Malleefowl (www.environment.gov.au/cgi-bin/sprat/public/sprat.pl)

Plate 16: The Malleefowl, *Leipoa ocellata* (http://www.malleefowl.com.au/)

DISTRIBUTION

The Malleefowl inhabits semi-arid regions of southern Australia (Benshemesh 2000). The Malleefowl is found in New South Wales, Victoria, South Australia and Western Australia (Figure 15). The distribution of the Malleefowl is severely fragmented which increases their risk of extinction (Benshemesh 2000).

Plate 17: Malleefowl working its nest

PREFERRED HABITAT

The Malleefowl is found principally in semi- arid to arid shrublands, low woodlands dominated by mallee and associated habitats such as broombush (*Melaleuca uncinata*). In the GVD, Malleefowl appear to prefer the smaller desert-mulga *Acacia minyura.* Studies have shown that the birds use vegetation adjacent sand plain areas for foraging where food resources are more common. The birds also occur in denser Mallee (*E. socialis, E. oxymitra*, and *E. gammophylla*). Typically, these Mallee areas have an understorey of *Triodia basedowii* or other *Triodia* species, and shrub thickets on the ridges where *Acacia ligulata* and other seed bearing shrubs are often common.

The breeding habitat of the Malleefowl is characterised by light soil and an abundant leaf litter, which is used in the construction of the nest mound.

CONSERVATION STATUS

The Malleefowl is considered to be of conservation concern to the TJV as it is listed under State and Federal legislation:

- WC Act – Schedule 1 - Fauna that is likely to become extinct
- EPBC Act – Vulnerable.

The IUCN consider the Malleefowl to be Vulnerable.

7.8. NARETHA BLUE BONNET - NORTHIELLA HAEMATOGASTER

SPECIES INFORMATION

The Naretha Blue Bonnet is an Australian parrot characteristically pale grey-brown parrot with deep blue forehead, face and bend of wing (Pizzey & Knight 2002) (Plate 18). They generally grow between 27-35 cm in length (Pizzey & Knight 2002). The Naretha Blue Bonnet is a subspecies of *Northiella haematogaster.*

They are usually seen in pairs or small groups of up to 20 birds. Boisterous and active, this species assembles early to drink and then goes off to feed. The Naretha Blue Bonnet eats the seeds of both native and exotic plants (Higgins 1999). The birds feed both on the ground and in trees. They nest in tree hollows and breed between July and December producing 4 to 7 white eggs (Higgins 1999).

DISTRIBUTION

In WA, the Naretha Blue Bonnet is restricted to the western side of the Nullarbor Plain (Figure 16) (Higgins 1999).

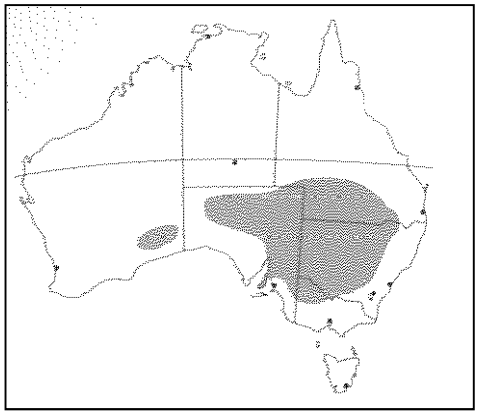


Figure 16: Distribution map of the Naretha Blue Bonnet (Pizzey & Knight 2002).

Plate 16: The Naretha Blue Bonnet, *Northriella haematogaster* (www.birdway.com.au)

PREFERRED HABITAT

Naretha Blue Bonnets are usually found in or within sight of *Casuarina* and *Acacia* woodland, and usually near shrubland. They are often found far from water. The Naretha Blue Bonnet moves seasonally with the rains.

CONSERVATION STATUS

The Naretha Blue Bonnet is considered to be of conservation concern to the TJV as it is listed under State legislation:

- WC Act – Schedule 4 - Other specially protected fauna.

The Naretha Blue Bonnet is considered to be of 'Least concern' by the IUCN.

7.9. PEREGRINE FALCON - FALCO PEREGRINUS

SPECIES INFORMATION

The male Peregrine is 355 - 390 mm and 420 - 480 g, the female is 415 - 460 mm and 765 - 960 g (Johnstone and Storr 1998). The adults head, nape and cheeks are black or blackish brown and the underparts are white or buff (Plate 19) (Pizzey and Knight 2002). The back, wings and tail coverts bluish grey, feathers barred blackish brown or greyish brown (Johnstone and Storr 1998).

The Peregrine feeds predominantly on other birds, it 'stoops' on birds such as pigeons, parrots and galahs. They nest mainly on ledges, granite outcrops and cliffs, the eggs are laid mainly in September.

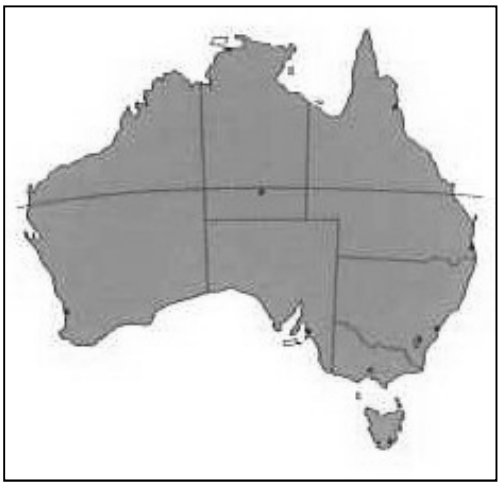


Figure 17: Distribution Map of *Falco peregrines* (Pizzey and Knight 2002)

Plate 19: *Falco peregrines* (http://animals.nationalgeographic.com/animals/birds/peregrine-falcon.html)

DISTRIBUTION

The Peregrine is uncommon with a wide distribution in Australia, but absent from most deserts and the Nullarbor Plain (Figure 17).

PREFERRED HABITAT

The species prefers habitat with rocky ledges, cliffs, watercourses, open woodland or margins with cleared land.

CONSERVATION STATUS

The Peregrine Falcon is considered to be of conservation concern to the TGP as it is listed under State legislation:

- WC Act – Schedule 1 - Fauna that is likely to become extinct.

7.10. PRINCESS PARROT - POLYTELIS ALEXANDRAE

SPECIES INFORMATION

The Princess Parrot is a very distinctive bird, which is slim in build, brightly coloured, and has a very long, tapering tail (Pavey 2006) (Plate 20). It is a medium-sized parrot with total length of 40 - 45 cm and body mass of 90 - 120 g (Pizzey & Knight 2002). The basic colour is dull olive-green; paler on the underparts. It has a red bill, blue-grey crown, pink chin, throat and foreneck, prominent yellow-green shoulder patches, bluish rump and back, and blue-green uppertail (Pizzey & Knight 2002).

The Princess Parrot is highly nomadic and occurs in small flocks of 10 - 20; however, groups of up to 100 birds do occur (Pavey 2006).

Breeding takes place in hollows in large eucalypts. Breeding colonies of up to 10 pairs are sometimes recorded but solitary nesting also occurs (Pavey 2006). The Princess Parrot feeds on the ground and in flowering shrubs and trees. The diet consists mostly of seeds with flowers, nectar and leaves being of secondary importance.

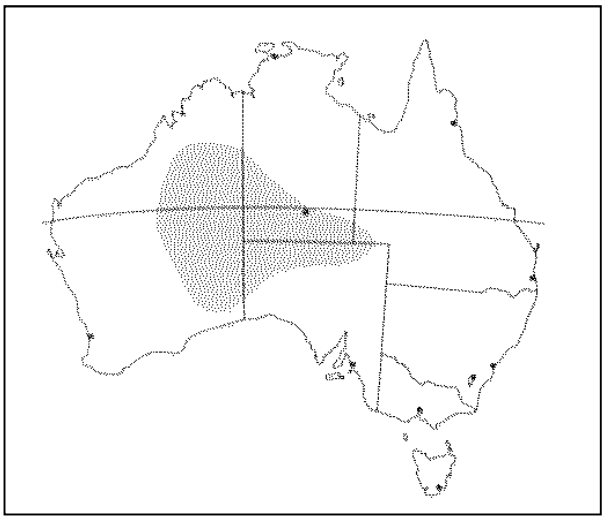


Figure 18: Distribution map of the Princess Parrot (www.environment.gov.au/cgi-bin/sprat/public/sprat.pl)

Plate 20: The Princess Parrot, *Polytelis alexandrae* (www.nt.gov.au/nreta/wildlife/animals/threatened/pdf/birds/princess_parrot_vu.pdf)

DISTRIBUTION

This species has a patchy and irregular distribution in arid Australia. The species is believed to exist in inland Australia, from south-west Queensland to the GVD in Western Australia (Figure 18) (Pizzey & Knight 2002).

PREFERRED HABITAT

The Princess Parrot usually occupies swales between sand dunes and is occasionally seen on slopes and crests of dunes. This habitat consists mostly of shrubs such as *Eremophila*, *Grevillea*, and *Hakea* and scattered trees. Some records are from riverine forest, woodland and shrubland. Breeding takes place in hollows in large eucalypts, particularly river red gums *E. camaldulensis*, and also in desert oaks *Allocasuarina decaisneana*.

CONSERVATION STATUS

The Princess Parrot is considered to be of conservation concern to the TJV as it is listed under State and Federal legislation:

- WC Act – Schedule 1 – Fauna that is likely to become extinct
- EPBC Act – Vulnerable.

The IUCN considers the Princess Parrot to be Near Threatened.

7.11. SLENDER-BILLED THORNBILL - ACANTHIZA IREDALEI IREDALEI

SPECIES INFORMATION

The western subspecies of the Slender-billed Thornbill is a small bird, with head and body length of 9 - 10 cm and a mass of about 5 - 6 g (Pavey 2006) (Plate 21). The upperparts are light olive-grey to dark olive-brown (Pavey 2006). The rump and base of tail are buff-yellow to yellow-olive. The forehead and cheeks are scalloped and flecked pale to deep cream (Pavey 2006). The underparts are uniformly cream-white to cream-buff. The bill is dark and the eye pale (Pavey 2006).

The western Slender-billed Thornbill usually occurs in pairs, or in small flocks of up to 10 birds (Baxter & Paton 1998). Little is known about the breeding biology of the western Slender-billed Thornbill. It appears to breed in solitary pairs (DEWHA 2008a). However, based on behaviour recorded in other thornbill species, breeding may also be assisted by other birds in a co-operative breeding system (Recher & Davis 2000). Breeding activity has been recorded from July to October but the breeding season may also extend into November (Recher & Davis 2000).

The nests are dome-shaped or globular, have a side entrance and are usually placed amongst the upper branches of small samphire shrubs (Johnstone & Storr 2004), or occasionally in other shrubs such as *Acacia aneura* (Birds Australia Nest Record Scheme, unpublished data).

The western Slender-billed Thornbill feeds on invertebrates, mostly insects (including caterpillars, grasshoppers, beetles, bees and ants) spiders and, occasionally, centipedes (Recher and Davis 2000). It also feeds on the stems and/ or foliage of *Maireana sedifolia, M. pyramidata, Atriplex vesicaria, Acacia tetragonophyllya* and *Acacia aneura* (Matthew 1994).The western Slender-billed Thornbill forages on the ground and in low shrubs (Johnstone & Storr 2004; Recher & Davis 2000). Food items are mainly taken from foliage, but they may also be collected from twigs and flowers, and occasionally from branches or the air. Foraging takes placed throughout the day (Recher & Davis 2000).

DISTRIBUTION

The western Slender-billed Thornbill is endemic to Australia and occurs in arid and semi-arid regions of southern Western Australia and south-western South Australia (Figure 19) (Pavey 2006).

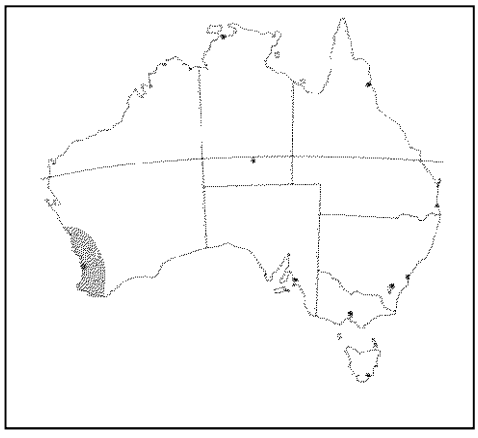


Figure 19: Distribution map of the Western Slender Thornbill (www.environment.gov.au/cgi-bin/sprat/public/sprat.pl)

Plate 21: The western Slender Thornbill, *Acanthiza iredalei iredalei* (www.nt.gov.au/nreta/wildlife/animals/threatened/pdf/birds/slenderbilled_thornbill_ex.pdf)

PREFERRED HABITAT

The western Slender-billed Thornbill occurs in shrubland, typically in areas of saltmarsh dominated by samphire, bluebush (*Maireana*) or saltbush (*Atriplex*) around salt lakes or low heath on sand plains (DEWHA 2008).

CONSERVATION STATUS

The western Slender-billed Thornbill is considered to be of conservation concern to the TJV as it is listed under State and Federal legislation:

- WC Act – Schedule 1 – Fauna that is likely to become extinct
- EPBC Act – Vulnerable.

The IUCN considers the western Slender-billed Thornbill as fauna of 'Least Concern'.

7.12. STRIATED GRASSWREN - AMYTORNIS STRIATUS STRIATUS

SPECIES INFORMATION

Amytornis striatus striatus is a subspecies of the Striated Grasswren. The Striated Grasswren is a soft red-brown, streaked white, with an orange-buff eyebrow, a white throat (Plate 22) (Pizzey & Knight 1997). The size ranges from 14.5-19.5 cm. The Striated Grasswren is elusive and exists in pairs and family parties.

The Striated Grasswren breeds in August-November, the nest is domed and consists of Spinifex spines in Spinifex clumps lined with bark-strips (Pizzey & Knight 1997).

DISTRIBUTION

The Striated Grasswren inhabits the arid zones of Australia and is widespread in inland western Australia and the Pilbara (Figure 20).

PREFERRED HABITAT

This subspecies of Striated Grasswren inhabits spinifex on sandhills and rocky hillslopes and may occur in the survey area. The species' presence is strongly correlated with vegetation communities that support hummock grassland (*Triodia* sp.).

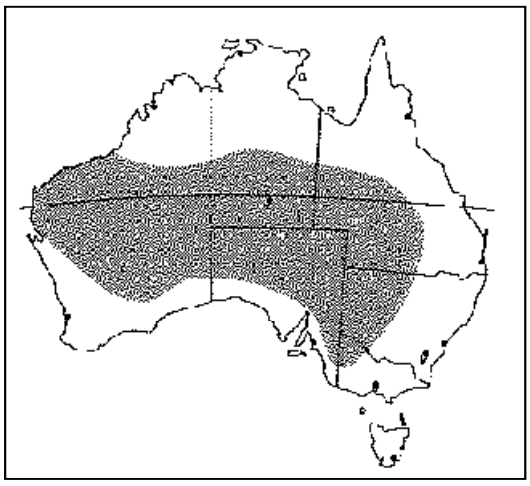


Figure 20: Distribution map of the Striated Grasswren (Pizzey and Knight 1997)

Plate 22: Striated Grasswren *Amytornis striatus* (http://farm3.static.flickr.com/2086/2090041382_83535253e3.jpg?v=0)

7.13. THICK BILLED GRASS-WREN - AMYTORNIS TEXTILIS TEXTILIS

SPECIES INFORMATION

The Thick-billed Grasswren *Amytornis textilis* is one of eight species of grasswren that occur in the semi-arid and arid regions of Australia. Three subspecies of the Thick-billed Grasswren are recognised: *A. textilis textilis* from Western Australia, A*. textilis myall* from the Gawler Range in South Australia and A. textilis modestus from inland eastern Australia (CALM 2000). The subspecies recorded in the Neale Junction in 1974 was the western subspecies, *A. textilis textilis*.

The Thick-billed Grasswren is approximately 165-190 mm in length and 18-26 g. The male has a stout bill, head streaks and whisker-mark (Plate 23) (Simpson and Day 1998). It is dark amber above and paler below, the throat and breast has white streaks (Plate 23) (Simpson and Day 1998). The female typically has rufous flanks (Simpson and Day 1998).

Individuals are very shy and elusive and rarely call. The species forages on the ground and in bushes for seeds, small berries and small beetles (Simpson and Day 1998). They form established pairs and maintain territories of 20-40 hectares year-round. Breeding occurs from August to January and March and May (Simpson and Day 1998).

DISTRIBUTION

The western subspecies of the Thick-billed Grasswren once extended from Shark Bay over much of southern Western Australia (Figure 21) (CALM 2000). Historically, the 'western' Thick-billed Grasswren had a wide distribution throughout arid western Australia including Kalgoorlie and Laverton (CALM 2000). There is some doubt as to the current extent of the Thick-billed Grasswren over the Nullarbor Plain and arid inland. Since the early 1900s the Thick-billed Grasswren has declined markedly in its distribution and currently is restricted to the Shark Bay region, including Peron Peninsula and the nearby pastoral stations (CALM 2000).

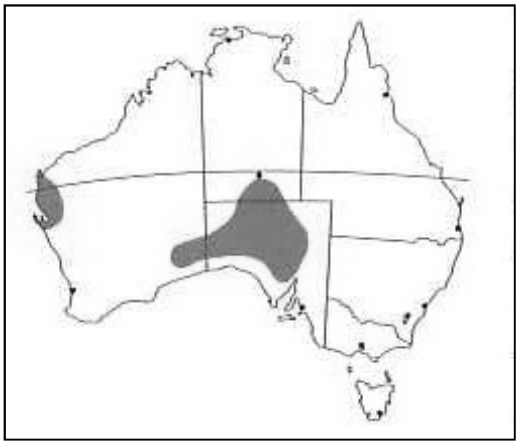


Figure 21: Distribution map of the Thick-billed Grasswren (Pizzey and Knight 2002). Current distribution of the western species marked.

Plate 23: The Thick-billed Grass-wren *Amytornis textilis textilis* (www.saalnrm.sa.gov.au/Portals/6/communication/Grasswren%20fact%20sheet.pdf)

PREFERRED HABITAT

Historical descriptions of the habitat of the Thick-billed Grasswren are limited, but it appeared to show a preference for areas with dense cover. The Thick-billed Grasswren was found in areas of 'thick bush' or 'thickets', dense saltbush, in 'marlock' or low mallee scrub and in 'large clumps of bushes which had extremely dense masses of foliage (CALM 2000).

CONSERVATION STATUS

The Thick-billed Grasswren is considered to be of conservation concern to the TJV as it is listed under State legislation as Priority 4 – Taxa in need of monitoring. There have been two sightings of the species in the Neale Junction Reserve.

7.14. MIGRATORY BIRDS

Migratory birds potentially occurring within the survey area are listed in Table 3. Human activities have threatened many migratory bird species. Birds are vulnerable to the effects of urbanization and development, especially with the reduction of nesting and feeding habitats. The main threats to migrating birds are habitat loss, habitat degradation and harvesting (DEWHA 2008b). The distances involved in bird migration mean that they often cross political boundaries of countries and conservation measures require international cooperation. The Australian Government uses the EPBC Act to protect and manage threatened migratory species.

Table 3: Migratory birds protected by the EPBC Act that potentially occurring within either survey area.

Scientific Name	Common Name	Comment
Apus pacificus	Fork-tailed Swift	This species is widely distributed in Australia and is categorized as 'Least Concern' by the IUCN.
Ardea ibis	Cattle Egret	This species is widely distributed in Australia and is categorized as 'Least Concern' by the IUCN.
Charadrius veredus	Oriental Plover, Oriental Dotterel	This species is widely distributed in Australia and is categorized as 'Least Concern' by the IUCN.
Leipoa ocellata	Malleefowl	See section 7.4
Merops ornatus	Rainbow Bee-eater	The Bee-eater is a common migratory visitor to Australia with a distribution covering all states. It is capable of flying long distances and therefore is unlikely to be negatively impacted by the proposed action. It is categorized as 'Least Concern' by the IUCN.

All of the migratory birds listed in Table 3 with the exception of the Malleefowl have a wide distribution covering all states in Australia therefore it is unlikely they will be negatively impacted by the borefield and pipeline network.

7.15. GREAT DESERT SKINK EGERNIA KINTOREI

SPECIES INFORMATION

The Great Desert Skink (GDS) or Tjakura is a large burrowing lizard which weighs up to 350 g and is about 440 mm from the snout to the tip of the tail (DEWHA 2008c) (Plate 24). They have reddish-tan smooth upper scales while the under-parts range from vivid lemon yellow to creamy grey (DEWHA 2008c). The tail is longer than the body, and in good seasons the base of the tail becomes swollen with stored fat reserves.

The GDS lives communally in burrow systems of up to 10 m in diameter, with multiple entrances (McAlpin 2001). The mating season occurs in spring and summer. Dispersal occurs when lizards reach maturity in their second year, with young lizards often living alone in small burrow systems (McAlpin 2001). It is at this time that predation pressure is likely to be greatest (McAlpin 2001).

Lizards may move up to 100 m from their burrow when foraging. Individuals may move 10 km or more to colonise new areas (McAlpin 2000).

The GDS feeds on termites and supplements this diet with cockroaches, beetles, spiders and ants (Cogger 2000). Most of their burrow systems are located close to termite nests, and the lizards catch termites when they come to the surface to harvest grasses or during dispersal of winged adults. Most foraging is done in the early evening or during the night in hotter months. The GDS hibernates within specially constructed chambers in their burrow systems over the cooler months. Most lizards enter hibernation by the end of May, though some may wait until mid June. Lizards emerge in September or October (McAlpin 2007).

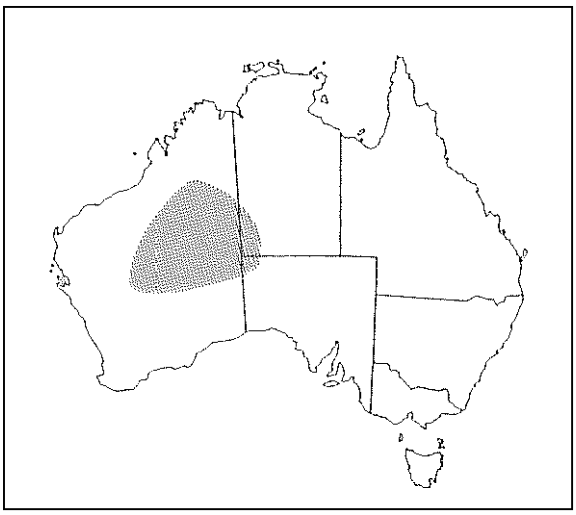


Figure 22: Distribution map of the Great Desert Skink (www.environment.gov.au/cgi-bin/sprat/public/sprat.pl)

Plate 24: The Great Desert Skink, *Egernia kintorei* (www.abc.net.au/nature/australasia/)

DISTRIBUTION

The GDS inhabits the sandy desert regions of central Australia (Figure 22). The largest populations survive in the Tanami and GVD regions, with smaller fragmented populations existing in the Gibson, GVD and Great Sandy Desert regions of Western Australia, and a very small population known from the northern Anangu-Pitjantjatjara (Figure 22) (DEWHA 2008c).

PREFERRED HABITAT

The species generally occurs on red sand plains and sand ridges and they generally prefer spinifex (*Triodia* species and *Plectrachne* species) grassland sand plains and some adjacent dune field swales (Cogger 2000). Regenerating vegetation appears to be a critical habitat requirement (McAlpin 2001). Skinks appear to prefer a mosaic landscape of different aged vegetation and inhabit sites that have been burnt in the previous 3 - 15 years (McAlpin 2001). Preferred habitat has at least 50 % bare ground (McAlpin 2001). Regenerating areas may provide ample food while unburnt patches provide shelter (Pearson et al. 2001). The reproductive output of burrows is highest in areas burnt in the previous 10 years (McAlpin 2001).

CONSERVATION STATUS

The GDS is considered to be of conservation concern to the TJV as it is listed under State and Federal legislation:

- WC Act – Schedule 1 - Fauna that is likely to become extinct
- EPBC Act – Vulnerable.

The IUCN considers the GDS as Vulnerable.

8 ECOLOGICAL COMMUNITIES

A search of the DEC's Threatened Ecological Communities database found that there are no known TECs or PECs occurring within the survey area.

9 AREAS OF CONSERVATION SIGNIFICANCE

The proposed area of impact does not include nature reserves or regionally significant features such as protected wetlands. The survey area abuts the Neale Junction Nature Reserve which covers an area of around 72,000 hectares (Figure 1).

10 RISKS/THREATENING PROCESSES

This desktop assessment highlights the distinct lack of baseline information regarding threatened species in the survey area. Without baseline information on the species distribution and biology it is difficult to be confident in determining potential impacts on threatened flora, fauna and regionally significant vegetation communities. As previously mentioned there have been few surveys conducted in the area, consequently the lack of threatened species and apparent limited diversity is likely due to the limited sampling in the area.

Land clearing of terrestrial native vegetation for the installation of bores, pipeline network and associated activities presents a potential threat to the local environment. Clearance of native vegetation reduces the continuous natural range of ecosystems as well as the diversity of habitats and can impede ecological processes occurring within them.

The installation of bores and pipeline network raises the following potential threats to flora and vegetation:

- Unnecessary loss of flora due to excessive or poorly planned vegetation clearing.
- Changes to the local topography through bore and pipeline installation may impact the natural vegetation and flora that occur in the survey area (e.g., through alterations to surface and/or groundwater flows).
- The introduction of weeds to an area has the potential to degrade an ecosystem, either by interfering with natural function, displacing native species, inhibiting regeneration, affecting nutrient cycling, changing fire characteristics, or by out-competing native species for resources. Weeds are often disturbance opportunists, responding rapidly to land or human disturbance.
- Bushfires and changes to the local fire regime, such as increased frequency and/or intensity of fires, have the potential to impact negatively on local flora.
    - Bushfires generated by human activity/ construction activities have the potential to reduce the size of patches of fire sensitive vegetation, alter the structure, composition and abundance of vegetation, change the timing of fruiting and seeding of species and increase the prevalence of fire-promoting grasses (LandCare 2005).
    - Changed fire regimes (changes in intensity and/ or frequency) pose a significant threat to threatened flora species that are fire sensitive.

Clearing of native vegetation for the installation of the bores and pipeline network may result in:

- Changes to the local surface water flow patterns (i.e. through the construction of service infrastructure and diversions).
- Decline of surface water quality due to erosion from disturbed areas.
- Loss or deterioration of ecological communities and adverse impacts on flora and fauna species.

Due to the specific habitat requirements discussed in this assessment, the fauna species potentially occurring within the survey area are highly susceptible to perturbation. Specifically the construction of the pipeline network and associated works poses the following threats:

- Direct mortality and entrapment from pipeline construction activities and traffic.
- Habitat loss and degradation.
- Fragmentation of habitat, discontinuity, dispersal reduction and isolation of breeding populations.
- Attraction of pest species from human activity resulting in predation and/or competition with native species. The red fox, domestic cat and European rabbit have been recorded in the area.
- Fire resulting in mortality and loss/alteration of significant habitat.
- Operation of the borefield is likely to require on-site fuel storage facilities which, if inappropriately managed, have the potential to result in spills and/or contamination.

11 DISCUSSION – MANAGEMENT RECOMMENDATIONS

Best practice management techniques can be used to minimise the potential impacts of the borefield and associated pipeline network. These should include:

11.1. FLORA AND VEGETATION

- Minimise the area cleared.
- Identify areas not to be disturbed for conservation reasons (flora and/ or fauna) and ensure that staff and contractors are aware of restrictions.
- Avoid areas that host a number of species of conservation concern.
- Identify and target key flora species for revegetation and seeding programs.

11.2. REHABILITATION

- Reinstate soil and vegetation where possible after installation within one season to maximise chances of re-colonisation from seed bank.
- Rehabilitation should occur where practical to provide stability, reduce erosion and restore the original structure and composition.

11.3. FAUNA

- Timing of clearing operations selected to minimise impacts on breeding species, where practicable (e.g., Rainbow Bee-eater which is known to nest in stockpiled soil/ substrate).
- Facilitate recolonisation by local fauna by retaining cleared logs in rehabilitated areas.
- Plan alignment to minimize the number of trees to be felled.
- In the event that tree felling is unavoidable, inspection of felled trees to remove, relocate or render assistance to injured fauna should be carried out by an appropriately trained person.
- Relocate fauna of conservation concern if found during pipeline installation.

11.4. SURFACE WATER AND DRAINAGE

- Erosion and sedimentation mitigation measures employed where clearing is in close proximity to standing water. Alternatively, carry out installation in the dry season.
- Minimise disturbance and control run-off from construction areas.
- Ensure appropriate design of storage areas and temporary drainage systems.

11.5. PEOPLE MANAGEMENT

- Fire hazard awareness and management training of TGP personnel and contractors including emergency response procedures.
- All site personnel to be educated in recognising flora and fauna species of conservation concern.
- No access to areas outside of the site to avoid unauthorised disturbance.
- Isolate and remove all waste, particularly food waste, from the work area.

12 REFERENCES

- Allen 1997, GSWA *Hydrogeology Report 1991/26*. Western Australian Geologist, No 396.
- Australian Geological Survey Organisation Geology Sheets 1995. Australian Geological Survey Organisation Geology Sheets – Sheet Neale.
- Barton, B & Cowan, M 2001. 'Great Victoria Desert 2 (GVD2 – Great Victoria Desert Central subregion)' In *A Biodiversity Audit of Western Australia's 53 Biogeographical Subregions in 2002,* Department of Conservation and Land Management, Perth, pp. 351-357
- Baxter, C & PA, Paton 1998. 'Further notes on the birds of the Gawler Ranges' *South Australian Ornithologist*, vol. 33, pp. 1-15.
- Beard, JS 1975. *Vegetation Survey of Western Australia Great Victoria Desert.* 1:1,000,000 Vegetation Series. Explanatory Notes to Sheet 3.
- Benshemesh, J 1999. 'The National Malleefowl Recovery Plan: a framework for conserving the species across Australia' *Proceedings Third International Megapode Symposium*, Zool. Verh. Leiden, pp. 327.
- Benshemesh, J 2000. 'National Recovery Plan for Malleefowl'. South Australian Department for Environment and Heritage.
- Benshemesh, J 2004. 'Recovery Plan for Marsupial Moles *Notoryctes typhlops* and *N. caurinus*. 2005-2010'. Northern Territory Department of Infrastructure, Planning and Environment, Alice Springs.
- Bureau of Meteorology 2008. http://www.bom.gov.au/ Accessed June 2008.
- CALM 2000 *Thick-billed Grasswren (Western Subspecies) (Amytornis textilis textilis) Interim Recovery Plan 2000 – 2002.* Department of Conservation and Land Management Western Australian Threatened Species and Communities Unit.
- Cogger, HG 2000. *Reptiles and Amphibians of Australia*. Reed New Holland, Sydney.
- Commonwealth Government 2008. Australian Natural Resources Atlas – Great Victoria Desert. http://www.anra.gov.au/topics/rangelands/overview/wa/ibra-gvd.html
- Department of the Environment, Water, Heritage and the Arts 2008a. http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=25967 Accessed May 2008.
- Department of the Environment, Water, Heritage and the Arts 2008b. http://www.environment.gov.au/biodiversity/migratory/ Accessed May 2008.
- Department of the Environment, Water, Heritage and the Arts 2008c. http://www.environment.gov.au/cgi-bin/sprat/public/spratlookupspecies.pl?name=Great+Desert+Skink&searchtype=Wildcard. Accessed May 2008.
- *ecologia* Environment 2007. *Group 2 Southern Marsupial Mole Survey (draft).* Unpublished report prepared for AngloGold Ashanti Australia, December 2007.
- Environmental Protection Authority 2004a. *Guidance Statement No. 51 Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia*.
- Environmental Protection Authority 2004b. *Guidance Statement No. 56 Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia.*
- Garnett and Crowley 2000. Crested Bellbird (Southern) Taxon Summary. http://www.environment.gov.au/biodiversity/threatened/publications/action/birds2000/pubs/crested-bellbird.pdf Accessed 3 September 2008.
- Geoscience Australia 2008. http://www.ga.gov.au/oceans/ea_Officer.jsp Accessed 3 September 2008
- Government of New South Wales 2007. Department of Environment and Climate Change. http://www.threatenedspecies.environment.nsw.gov.au/index.aspx Accessed 12/10/2007.

- Government of South Australia 2007, South Australian Arid Lands Natural Resources Management Board. http://www.saalnrm.sa.gov.au/ Accessed 9/10/2007.
- Government of Western Australia 2008. *Western Australian Government Gazette No. 12* pp 177-185.
- Higgins, PJ (ed.) 1999, *Handbook of Australian, New Zealand and Antarctic Birds.* Volume 4: Parrots to Dollarbird, Oxford University Press, Melbourne.
- Johnson, KA 2002. Marsupial mole, *Notoryctes typhlops.* In *The Mammals of Australia* (ed R. Strahan.) pp. 409-411. (Australian Museum, Sydney).
- Johnstone, RE & Storr GM 2004. 'Handbook of Western Australian Birds'. In *Volume 2: Passerines* (Blue-winged Pitta to Goldfinch). Western Australian Museum, Perth.
- LandCare 2005, *The Fire Book*. Tangentyere Landcare's Land & Learning Program, Northern Territory.
- Matthew, J 1994. 'The status, distribution and habitat of the Slender-billed Thornbill *Acanthiza iredalei* in South Australia', *South Australian Ornithologist*, Vol. 32, pp.1-19.
- McAlpin, S 2001. 'A Recovery Plan for the Great Desert Skink (*Egernia kintorei*) *2001–2011*' Arid Lands Environment Centre, Alice Springs NT.
- Menkhorst, P & Knight, P 2004. *A Field Guide to the Mammals of Australia*. Oxford University Press, Victoria.
- Pavey, C 2006. 'Princess Parrot *Polytelis Alexandra*', Threatened Species of the Northern Territory.
- Pearson, DJ, & Turner, J 2000. *Marsupial moles pop up in the Great Victoria and Gibson Desert.* Australian Mammalogy, 22: 1 15.
- Pizzey, G & Knight, F 2002. *The Field Guide to the Birds of Australia*, Angus and Robertson, NSW.
- Queensland EPA 2007. Major Mitchell's cockatoo *Cacatua leadbeateri.* Conservation Management Profile.
- Recher, HF & Davis, WE 2000. 'A contribution to the natural history of the Slender-billed Thornbill *Acanthiza iredalei* in Western Australia', *Australian Bird Watcher,* vol.18, pp. 297-305.
- Shephard, M 1995. The Great Victoria Desert. North of the Nullarbor South of the Centre. Reed Books.
- Simpson and Day 1998. *The Claremont Field Guide to the Birds of Australia*. Lifetime Distributors, NSW.
- Woolley, PA 2005. The species of *Dasycercus* Peters, 1875 (Marsupialia: Dasyuridae). Memoirs of Museum Victoria 62(2): 213–221
- Woolley, PA 2002. Mulgara, *Dasycerus cristicauda.* In *The Mammals of Australia* (ed R. Strahan.) pp. 409-411. (Australian Museum, Sydney).

APPENDICES

Appendix A: Flora Conservation Codes

Protected/ Recognised Under:	Category	Description
EPBC Act	Extinct	There is no reasonable doubt that the last member of the species has died.
	Extinct in the Wild	A native species: • is known only to survive in cultivation or as a naturalised population well outside its past range; and, • has not been recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.
	Critically Endangered	A native species facing an extremely high risk of extinction in the wild in the immediate future.
	Endangered	A native species: • is not critically endangered; and • is facing a very high risk of extinction in the wild in the near future.
	Vulnerable	A native species: • is not critically endangered or endangered; and • is facing a high risk of extinction in the wild in the medium-term future.
	Conservation Dependent	The species is the focus of a specific conservation program the cessation of which would result in the species becoming vulnerable, endangered or critically endangered.
WC Act	Declared Rare Flora	A native species which has been adequately searched for, and are deemed to be in the wild either rare, in danger of extinction, or otherwise in need of special protection, and have been gazetted as such, following approval by the Minister for the Environment, after recommendation by the State's Endangered Flora Consultative Committee.
DEC Priority	Priority 1	A native species which is known from one or a few (generally <5) populations which are under threat, either due to small population size, or being on lands under immediate threat, e.g. road verges, urban areas, farmland, active mineral leases, etc., or the plants are under threat, e.g. from disease, grazing by feral animals, etc. May include taxa with threatened populations on protected lands. Such taxa are under consideration for declaration as 'rare flora', but are in urgent need of further survey.
	Priority 2	A native species which is known from one or a few (generally <5) populations, at least some of which are not believed to be under immediate threat (i.e. not currently endangered). Such taxa are under consideration for declaration as 'rare flora', but are in urgent need of further survey.
	Priority 3	A native species which is known from several populations, at least some of which are not believed to be under immediate threat (i.e. not currently endangered). Such taxa are under consideration for declaration as 'rare flora', but are in need of further survey.
	Priority 4	A native species which is considered to have been adequately surveyed and which, whilst being rare (in Australia), are not currently threatened by any identifiable factors. These taxa require monitoring every 5–10 years.

Appendix B - Fauna Conservation Codes Definitions

Protected/ Recognised Under:	Category	Description
EPBC Act	Extinct	There is no reasonable doubt that the last member of the species has died.
	Extinct in the Wild	A native species: • is known only to survive in captivity or as a naturalised population well outside its past range; and, • has not been recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.
	Critically Endangered	A native species facing an extremely high risk of extinction in the wild in the immediate future.
	Endangered	A native species: • is not critically endangered; and • is facing a very high risk of extinction in the wild in the near future.
	Vulnerable	A native species: • is not critically endangered or endangered; and • is facing a high risk of extinction in the wild in the medium-term future.
	Conservation Dependent	The species is the focus of a specific conservation program the cessation of which would result in the species becoming vulnerable, endangered or critically endangered.
	Marine	Marine species including some birds.
	Migratory	The entire population, or any geographically separate part of the population of any species or lower taxon of wild animal, a significant proportion of whose members cyclically and predictably cross one or more national jurisdictional boundaries.
WC Act	Schedule 1	A native species that is rare or likely to become extinct, are declared to be fauna that is in need of special protection.
	Schedule 2	A native species that is presumed to be extinct, are declared to be fauna that is in need of special protection.
	Schedule 3	Birds that are subject to an agreement between the governments of Australia and Japan relating to the protection of migratory birds and birds in danger of extinction, are declared to be fauna that is in need of special protection.
	Schedule 4	A native species that is in need of special protection, otherwise than for the reasons specified in Schedules 1, 2 and 3.
DEC Priority	Priority 1	A native species that is known from few specimens or sight records from one or a few localities on lands not managed for conservation, e.g., agricultural or pastoral lands, urban areas, active mineral leases. The taxon needs urgent survey and evaluation of conservation status before consideration can be given to declaration as threatened fauna.
	Priority 2	A native species that is known from few specimens or sight records from one or a few localities on lands not under immediate threat of habitat destruction or degradation, e.g. national parks, conservation parks, nature reserves, State forest, vacant Crown land, water reserves, etc. The taxon needs urgent survey and evaluation of conservation status before consideration can be given to declaration as threatened

Protected/ Recognised Under:	Category	Description
		fauna.
	Priority 3	A native species that is known from few specimens or sight records from several localities, some of which are on lands not under immediate threat of habitat destruction or degradation. The taxon needs urgent survey and evaluation of conservation status before consideration can be given to declaration as threatened fauna.
	Priority 4	A native species that is considered to have been adequately surveyed, or for which sufficient knowledge is available, and which are considered not currently threatened or in need of special protection, but could be if present circumstances change. These taxa are usually represented on conservation lands.
	Priority 5	A native species that is not considered threatened but is subject to a specific conservation program, the cessation of which would result in the species becoming threatened within five years.