

Department for Environment and Heritage
Eyre Peninsula Yellow-tailed Black-Cockatoo
Calyptorhynchus funereus whitei Regional Recovery
Plan



Government
of South Australia



Australian Government

Department for Environment and Heritage

Eyre Peninsula Yellow-tailed Black-Cockatoo
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Recovery Plan

2008



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of South Australia

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1 SPECIES INFORMATION

1.1 Species name, taxonomy and description

1.1.1 Description of the species

The Yellow-tailed Black Cockatoo (*Calyptorhynchus funereus*, Shaw 1794) is a large (56-66cm) black parrot with a long tail, broad wings and strong bill. It is one of three species of Black-Cockatoo that occur in South Australia and can be easily distinguished by the yellow panels in its tail and yellow ear coverts. The species is sexually dimorphic with adult males having more pure yellow tail panels, dark bill colour, and a flesh pink periophthalmic (around the eye) ring. Females differ by having a greater proportion of black flecks within the yellow tail panels, a lighter bill and a dark grey periophthalmic ring. Female birds also tend to have a greater amount of yellow along the edge of breast feathers than males, giving them a more scalloped appearance. Juvenile birds appear most similar to adult females and are most easily distinguished by their often continuous begging calls. In flight, the Yellow-tailed Black-Cockatoo has a lanky appearance with deep languid wing-beats and a marked upward flick of wing tips at the end of each downstroke (Higgins, 1999).

There are currently three recognised subspecies for the Yellow-tailed Black-Cockatoo, these being *C. f. funereus* that is found through south-east Queensland, eastern New South Wales and eastern Victoria, *C. f. xanthanotus* that occurs in Tasmania and the islands of Bass Strait, and *C. funereus whitei* that occurs in western Victoria, and southern South Australia (Figure 1).

The Yellow-tailed Black-Cockatoo on Eyre Peninsula is geographically isolated from other populations in south eastern Australia including *C. f. whitei* populations on Kangaroo Island, Fleurieu Peninsula, south east South Australia and western Victoria and the Tasmanian population of *C. f. xanthanotus*.

Across Australia, it is estimated that the total Yellow-tailed Black-Cockatoo population is around 5,800-13,500 birds (Dawson 1994).

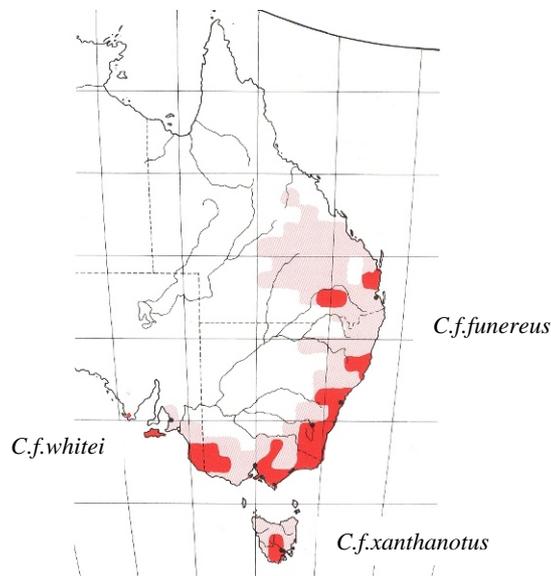


Figure 1 Distribution of the Yellow-tailed Black-Cockatoo in Australia (Modified version from Higgins 1999)

1.1.2 Taxonomy

DNA analysis has revealed some interesting traits concerning the genetics of Yellow-tailed Black-Cockatoos. Early genetic work had put forward several scenarios regarding Yellow-tailed Black-Cockatoo taxonomy, most of which have been superseded by more recent and extensive genetic analysis.

Until recently, two subspecies were recognised: *C.f. xanthanotus* to the west (populations in South Australia including Kangaroo Island, western Victoria and Tasmania) and *C.f. funereus* to the east (populations in eastern Victoria, New South Wales and Queensland) (Saunders 1979, Higgins 1999). It is unclear whether hybridisation occurs and the contact zone between *funereus* and *xanthanotus* is not well understood, although it is suggested to be somewhere between Melbourne and East Gippsland (Saunders 1979).

Eyre Peninsula birds are morphologically similar to other western populations in terms of plumage characteristics and overall size (Higgins 1999). Yellow-tailed Black-Cockatoos in SA, western Victoria and Tasmania have a more pronounced yellow scalloping pattern on body feathers and less black speckling on the yellow panels of tail feathers. They are also considerably smaller in overall size compared with birds from Queensland and NSW populations, particularly in tail and wing measurements. However, a 1977 study of Yellow-tailed Black-Cockatoo genetics by Christidis and Norman revealed that genetic samples from Eyre Peninsula birds resembled those from New South Wales *C. f. funereus* more closely than *C. f. xanthanotus* samples from south east South Australia and Tasmania (Christidis and Norman 1977).

Disjunct, demographically isolated populations have the potential to become genetically differentiated, and populations that have been isolated for the longest period of time are expected to have the highest level of genetic differentiation. The 1977 results suggested that the Eyre Peninsula birds have been separated the longest from south east South Australian birds than from those on the east coast. This also posed the question of whether the Eyre Peninsula population may be sufficiently genetically distinct from other populations to warrant subspecies status.

Additional DNA samples (i.e. feathers) were analysed in 2003 and more again between 2006-2008 to address the taxonomic ambiguities identified by the 1977 preliminary studies and to investigate the genetic distinctness of the Eyre Peninsula population (See Section 3.4).

The most current description of Yellow-tailed Black-Cockatoo taxonomy, based on genetic research to date (Janette Norman, Museum Victoria, *in prep*) is summarised below:

- An additional *whitei* complex, with *C.f. whitei* in South Australia (including Eyre Peninsula and Kangaroo Island) and western Victoria.
- *C. f. xanthanotus* in Tasmania only
- *C. f. funereus* in eastern Victoria, New South Wales and Queensland.
- Kangaroo Island contains the most pure *Whitei* birds, with the lowest frequency of introgression of east coast genes.
- Out-breeding depression is not an issue.
- Morphological variations such as bill size and structure, plumage characteristics and overall size are not reflected in genetic profiles and are not an indication of subspecies status as previously suspected. Morphological variations in Yellow-tailed Black-Cockatoos are more a reflection of environmental factors and phenotypic plasticity.
- Eyre Peninsula population is part of the *whitei* complex and not a distinct subspecies. The Eyre Peninsula population contains a higher frequency of gene introgression from east coast populations than do Victorian and Tasmanian populations and are genetically more similar to the birds from the east coast of Australia compared to Victoria or Tasmania, despite them looking physically different (J. Norman, pers. comm.)

The evidence of the *whitei* complex in a western population containing some east coast genes suggests that there were movements of Yellow-tailed Black-Cockatoos across Australia from the east to the west. This movement may have been relatively recent and in response to anthropomorphic changes (e.g. large scale habitat clearance in Victoria and NSW following

European settlement) or historical secondary contact and movements facilitated by previous land/habitat connections.

Several scenarios may explain these westwards movements:

1. Movement west from western Victoria and Tasmania via land bridges. Smaller bird species (e.g. wrens) have made this journey, so it is feasible for a large bird like a cockatoo.
2. Movement west from central Victoria. This scenario does not reflect the frequency of east coast genes in the western populations. If this scenario was true, it would be expected that the frequency of east coast genes would decrease further westwards, but east coast genes actually increase in frequency with westward movements.
3. Movement west from New South Wales along water courses e.g. Murray/Darling system. Based on the current data, this is the most likely scenario (J. Norman, pers. comm.)

Genetic analyses are still being conducted on the variation within and between South Australian populations (see Section 3.5). This will have an impact on management decisions and recovery actions involving re-stocking and translocation as this data will help determine whether Yellow-tailed Black-Cockatoo population in South Australia function as discreet populations or are a metapopulation. This may also identify the most likely pattern of historic westward movement.

1.2 Conservation Status

National Parks and Wildlife Act 1972 schedules (2000) classify all South Australia populations of *C. funereus* as Vulnerable (V). *C. funereus* has no conservation status nationally.

Yellow-tailed Black-Cockatoos have experienced a historical population decline over the last several decades and habitat loss, with its associated effects, is believed to be the principal cause. Lower Eyre Peninsula has experienced high levels of native vegetation loss associated with agriculture with the native vegetation remaining at between 7 and 15% of total land area (DEH 1997).

The Eyre Peninsula population of Yellow-tailed Black-Cockatoo is considered Critically Endangered by the Eyre Peninsula Yellow-tailed Black-Cockatoo Recovery Team (van Weenen and Cooper 2000), based on the IUCN (International Union for Conservation of Nature and Natural Resources/The World Conservation Union) Critically Endangered criteria (IUCN Red List 2001, Version 3.1). A taxon is Critically Endangered when the best available evidence indicates that it meets any of the criteria A to E for Critically Endangered, and it is therefore considered to be facing an extremely high risk of extinction in the wild. The Eyre Peninsula Yellow-tailed Black-Cockatoo meets the following IUCN criteria:

Criteria A: Reduction in population size

Criteria B: Reduction in geographical range in terms of

1. Extent of occupancy, and
2. Area of occupancy.

Criteria D: Population size estimated to number fewer than 50 mature individuals.

More details of the IUCN *Critically Endangered* Criteria can be found at web address: http://www.iucnredlist.org/info/categories_criteria2001#critical

1.3 Distribution

1.3.1 Present distribution

Eyre Peninsula Yellow-tailed Black-Cockatoos range from the southern tip of Eyre Peninsula north-westward to near Poochera (Figure 2). The Eyre Peninsula Yellow-tailed Black-Cockatoo has a seasonally and geographically split distribution across Eyre Peninsula. The birds breed during the warmer months (November-April) in the Lower Eyre Peninsula and migrate to north-western Eyre Peninsula for the winter.

Figure 2 demonstrates a reduction in the area covered by the Yellow-tailed Black Cockatoo in both their northern and southern range since the end of the 1930s/1940s (particularly peripheral sites). Previous discussions with landholders in the late 1990's have also indicated a declining population with many saying they used to observe the birds every year but haven't seen them in the last 5 to 15 years (van Weenen and Cooper 2000).

The summer breeding season is spent in a small area within the Koppio Hills approximately 40km north west of Port Lincoln on the Lower Eyre Peninsula. The Koppio Hills have been identified as the core breeding area, however the birds also utilise surrounding areas such as Edillilie, Koppio, Wanilla, Wanilla Forest and SA Water reserves such as Uley Basin west of the Flinders Highway (Figure 3).

Eyre Peninsula Yellow-tailed Black-Cockatoo winter habitat is located inland from Port Kenny and centres around farmland and remnant vegetation around Mount Cooper and Mount Damper, including Kulliparu Conservation Park. The northern extent of their distribution is believed to be Streaky Bay; however there have been un-confirmed reports in 2004 and 2005 of seven individuals as far north as Koongawa Dundey homelands approximately 15km north east of Ceduna (Figure 4).

1.3.2 Historical distribution

Few published historical records of the Eyre Peninsula population exist. The earliest record was from 2nd October 1899 when an adult male specimen was collected and labelled "Cockatoo Gully, Kapinka, Stokes, Flinders, Eyre's Peninsula" and donated to the SA Museum as part of the Captain SA White collection.

Notable absences of the population were noted on two major ornithological expeditions to Eyre Peninsula in 1911 and 1946 (van Weenen and Cooper 2000). Both expeditions concentrated on habitats within the cockatoos' breeding area; however the timing of both expeditions meant it was likely that individuals had not yet returned from the northern part of their range.

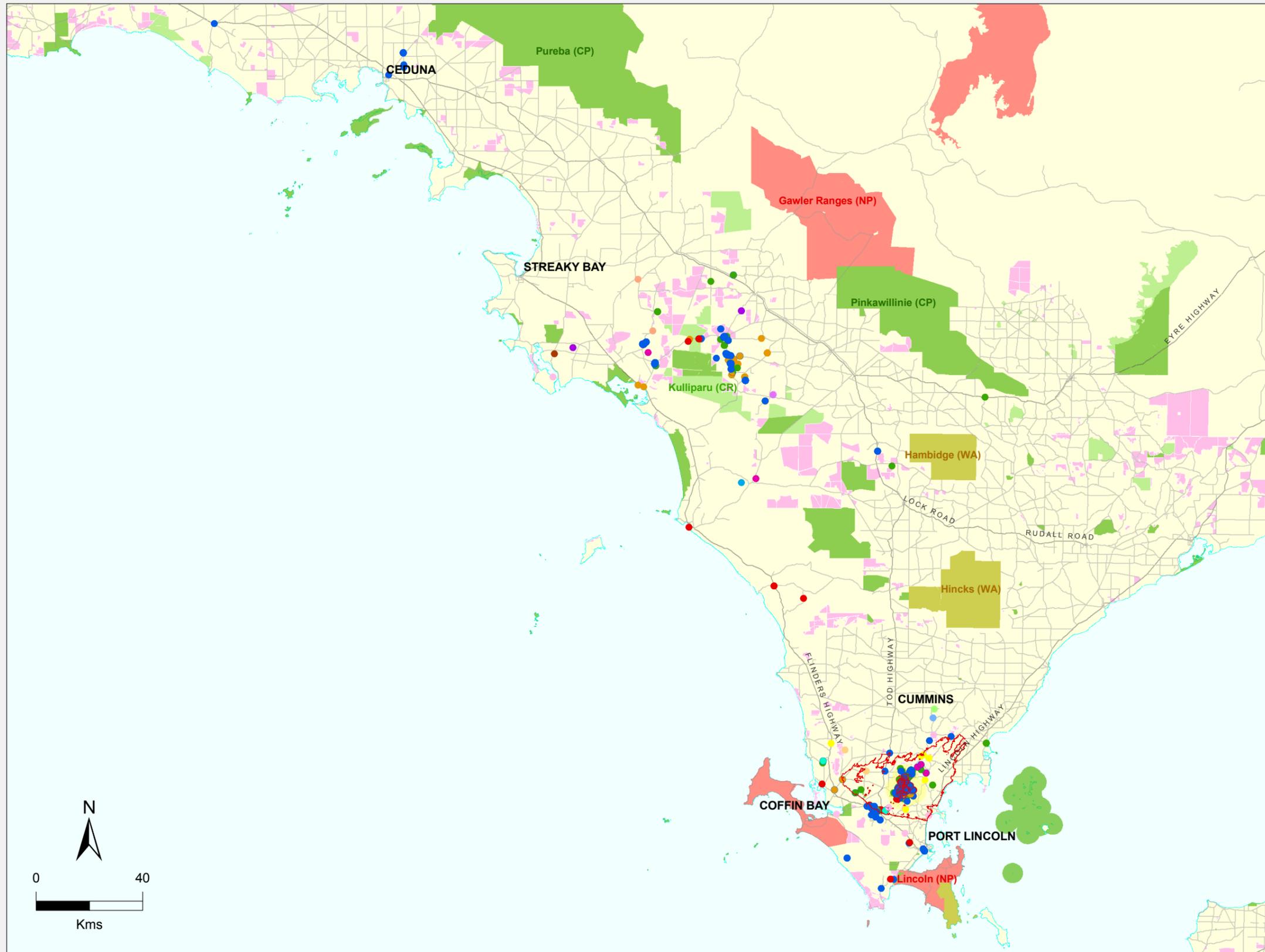
Historically, the southern breeding range stretched over most of Lower Eyre Peninsula from Kapinka in the north east, south to Sleaford Mere and west to the coast with the majority of the records from Wanilla Forest (formerly Wanilla State Forest) and the Koppio Hills (Figure 3). Published records from 1899-1940 and anecdotal evidence suggest that the northern range stretched from Inkster in the north, south-west to Baird Bay and east to Ucontitchie Rock covering an estimated 3500 square kilometres (Figure 4).

Large areas of heathland vegetation communities and heathy Sugar Gum Woodland habitats have been lost from Eyre Peninsula since European settlement (Figure 5). This historical clearance also represents the loss and fragmentation of important Eyre Peninsula Yellow-tailed Black-Cockatoo habitat components such as food plants and large hollow-bearing trees for nest sites. Possingham (1984) notes that several Eyre Peninsulas residents and their older relatives observed large flocks of up to a hundred cockatoos feeding in the heath land that once extended between the Koppio Hills and Marble Range in the 1920s and 1930s. Large areas of this habitat were lost during systematic clearance and the establishment of solidier settlements following World War Two.

Unpublished anecdotal evidence from older residents on Eyre Peninsula has been collected for a previous progress report (van Weenen and Cooper 2000). This vital historical evidence has been used to refine the past and present distribution of the population in both the summer and winter ranges (Figure 2) but unfortunately often lacks quantitative data.

Records of significance include observations of Yellow-tailed Black-Cockatoo foraging on grubs in wattle trees between 6th and 16th October 1909 at the foot of Marble Range (Hall 1910) as well as regular visits by the birds to Cash Hill and Mortana (J. Cash pers. comm.) on north-west Eyre Peninsula in the 1930s and Koyalla, north of Kapinka, on Eastern Eyre Peninsula in the 1920s and 1930s (B. Fitzgerald pers. comm.) Earlier still, L. Starkey (pers. comm.) at Conglimma and Inkster, remembers them at several locations in the district in the native pines and searching for borers in larger mallee.

Figure 2 Distribution of C. f. whitei on Lower Eyre Peninsula



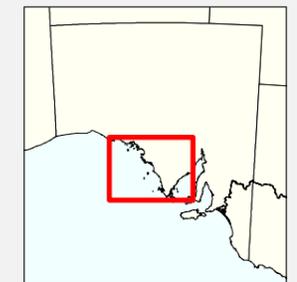
Eyre Peninsula Yellow-tailed Black-Cockatoo

- Activity**
- Breeding
 - Feeding
- Year of sighting**
- 1899
 - 1909
 - 1930 - 1940
 - 1935
 - 1970 - 1998
 - 1972
 - 1983 - 1984
 - 1989
 - 1989 - 1993
 - 1993 - 2001
 - 1994 - 1998
 - 1996 - 2001
 - 1998 - 1999
 - 2000 - 2001
 - 2002 - 2003
 - 2004 - 2005

■ 5km buffer zone around outer most EPYTBC breeding sites

NPWSA Reserves

- Conservation Parks
- Conservation Reserves
- National Parks
- Recreation Parks
- Wilderness Protection Areas
- Fire Boundary January 2005
- Roads
- Vegetation Heritage Agreements
- Tod River Reservoir



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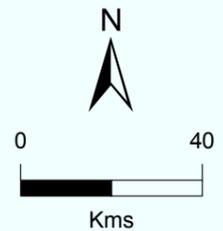
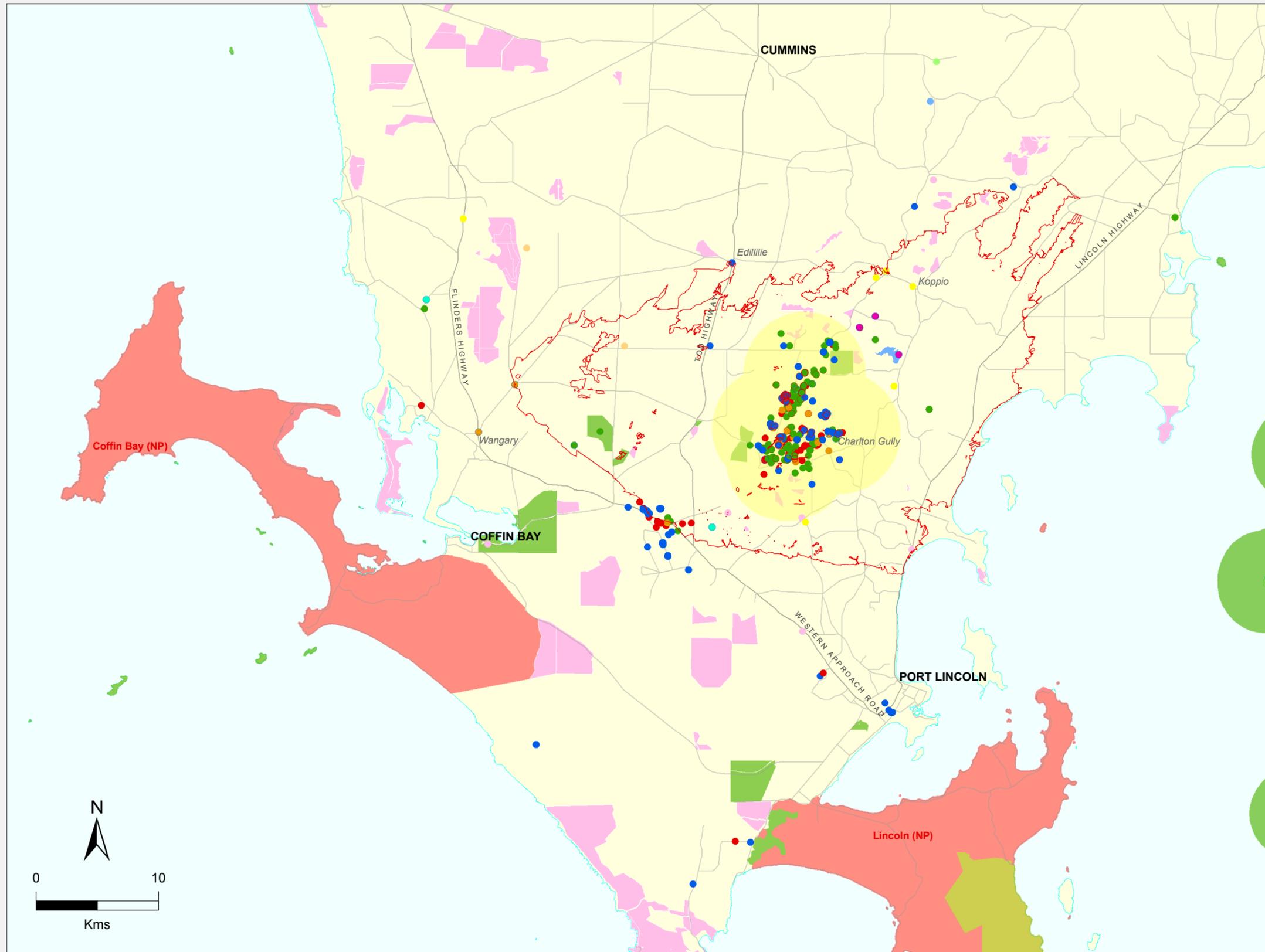


Figure 3 Distribution of *C. f. whitei* in summer breeding habitat on Lower Eyre Peninsula



Eyre Peninsula Yellow-tailed Black-Cockatoo

Activity

- Breeding
- Feeding

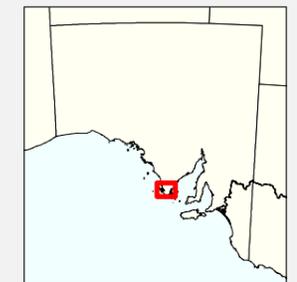
Year of sighting

- 1899
- 1909
- 1930 - 1940
- 1935
- 1970 - 1998
- 1972
- 1983 - 1984
- 1989
- 1989 - 1993
- 1993 - 2001
- 1994 - 1998
- 1996 - 2001
- 1998 - 1999
- 2000 - 2001
- 2002 - 2003
- 2004 - 2005

5km buffer zone around outer most EPYTBC breeding sites

NPWSA Reserves

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- ▭ Tod River Reservoir



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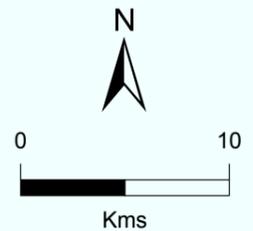
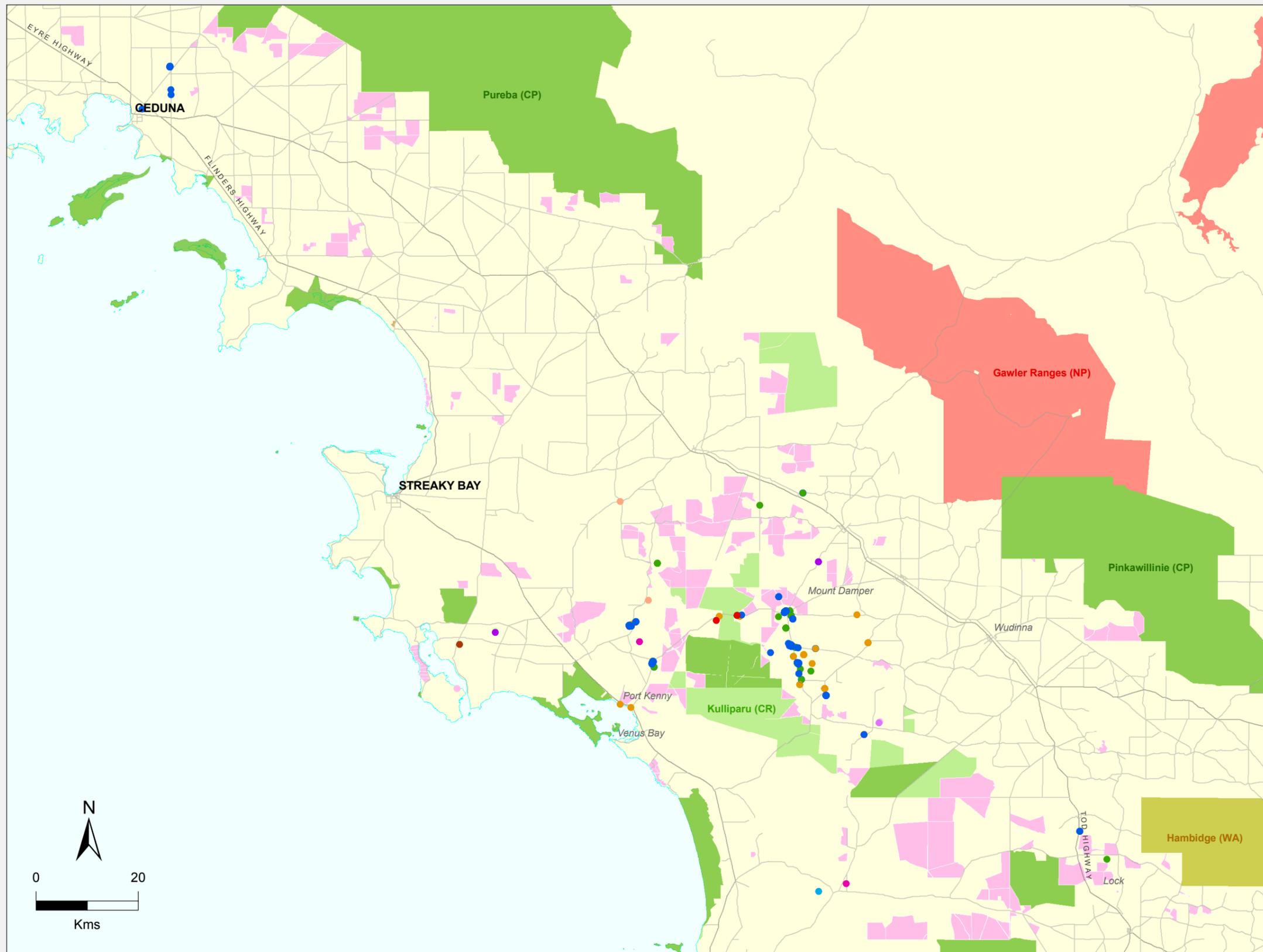


Figure 4 Distribution of *C. f. whitei* in over-wintering habitat on north western Eyre Peninsula



Eyre Peninsula Yellow-tailed Black-Cockatoo

- Activity**
- Breeding
 - Feeding
- Year of sighting**
- 1899
 - 1909
 - 1930 - 1940
 - 1935
 - 1970 - 1998
 - 1972
 - 1983 - 1984
 - 1989
 - 1899-1993
 - 1993 - 2001
 - 1994 - 1998
 - 1996 - 2001
 - 1998 - 1999
 - 2000 - 2001
 - 2002 - 2003
 - 2004 - 2005
- 5km buffer zone around outer most EPYTBC breeding sites

- NPWSA Reserves**
- Conservation Parks
 - Conservation Reserves
 - National Parks
 - Recreation Parks
 - Wilderness Protection Areas
- Fire Boundary January 2005
- Roads
- Vegetation Heritage Agreements
- Tod River Reservoir



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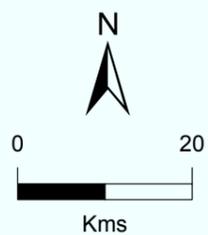
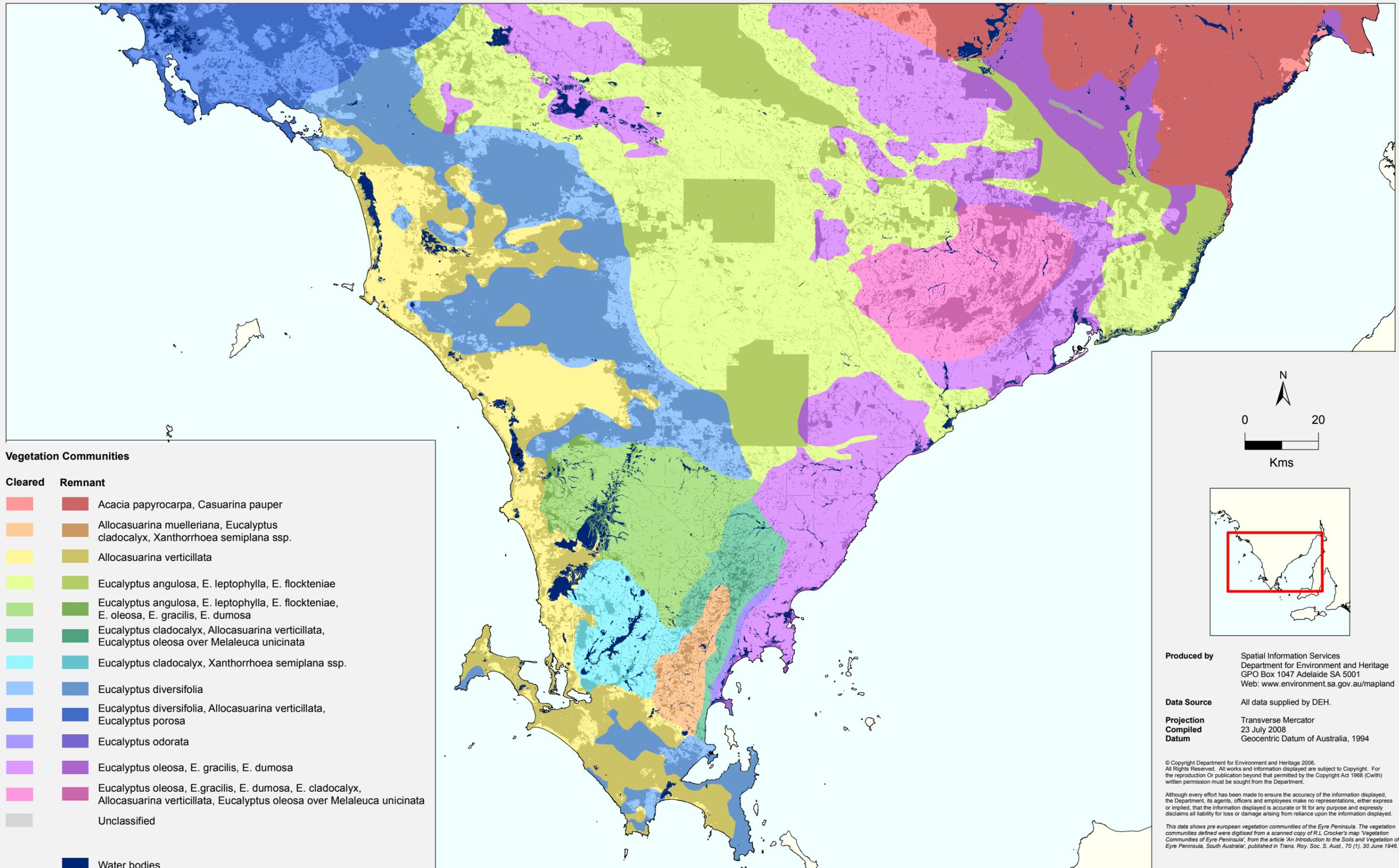


Figure 5 Loss of Eyre Peninsula vegetation communities since European settlement



1.4 Population size

The status of the Eyre Peninsula population remained largely unknown until studies conducted by Possingham (1984) and Nias (1987) revealed that fewer than 40 Yellow-tailed Black-Cockatoo remained. Habitat loss is believed to be the principle cause of historic population decline.

Recovery actions over the last seven years have increased Eyre Peninsula Yellow-tailed Black-Cockatoo numbers from as low as 19 birds in 1997 to an estimate of between 30 and 34 individuals prior to the devastating January 2005 "Black Tuesday" bushfire (from now on referred to as the *2005 fire*). It is unclear how many individuals were directly lost in the 2005 fire. The largest flock observed since the 2005 fire was 16 in February 2005. Since then, no subsequent observations of this number of birds have been made. The impacts of the 2005 fire on Yellow-tailed Black-Cockatoo recovery on Eyre Peninsula are discussed further in Sections 2.2.3 and 2.2.4

Current confirmed observations are of 9 individuals during the 2007/2008 breeding season and 9 individuals in the 2008 winter flock. Two, perhaps three individuals remained on Lower Eyre Peninsula during winter 2007 (a single record of one Eyre Peninsula Yellow-tailed Black-Cockatoo and another record of two Eyre Peninsula Yellow-tailed Black-Cockatoos on different days). Therefore, the maximum confirmed population is 11-12 individuals.

1.5 General biology

1.5.1 Breeding

The Eyre Peninsula Yellow-tailed Black-Cockatoo breeding season extends from November through to March. Pairs are monogamous, although individuals may take on another mate if their original partner dies. Clutch size is generally two eggs (Saunders 1979). Laying interval varies, but is generally four to seven days (Higgins 1999). The second egg is generally smaller in size and weight compared to the first egg. Usually only one chick survives despite two eggs often being laid. The second and smaller chick is often out-competed by its older sibling. This is a common reproductive strategy for many Australian parrots where the second egg functions as an "insurance policy" if the first egg fails. Breeding pairs raise one clutch per season, although they may have a second breeding attempt if the first nest fails, particularly if this occurs early in the season.

Eyre Peninsula Yellow-tailed Black-Cockatoos return to the same breeding area every season. This habitual use of breeding habitat by the birds is exhibited regionally (the birds always return to the southern Eyre Peninsula to breed), locally (the birds always utilise the same breeding area in the Koppio Hill) and discreetly, such that the same remnant woodland patches are utilised for nesting sites.

Nest sites are chosen during late October through to December and involves close inspection and often preparation (chewing inside and around the opening of the hollow) of several nest sites. Breeding pairs may utilise the same nest in consecutive years, however more than one breeding pair may use the same nest in subsequent years. Nest monitoring data has confirmed some banded juveniles returning to their natal nest site to breed (S. Way, DEH Threatened Fauna Officer *pers. obs.*)

Incubation is between 28-31 days and is performed by the female. The male feeds the female at or near the nest hollow several times a day during incubation by regurgitating food for her. He will also roost either in the nest tree or in an adjacent tree. Whilst incubating, the female only leaves the nest briefly to drink and receive food from her mate. Once hatched, both the male and female feed the chick. Chicks are fed early in the morning and late in the afternoon, however, occasionally feeding visits during the middle of the day may also occur. Fledging occurs at around three months when the chick is approximately 600-700g. The chick still continues to be fed by its parents up to 12-18 months old.

Morphological differences between the sexes become apparent at sexual maturity, which occurs at two to three years of age.

1.5.2 Foraging ecology

Eyre Peninsula Yellow-tailed Black-Cockatoos display habitual feeding behaviour and have strong site fidelity for key habitat components such as watering points, food resources, roosting sites and nest trees (see Section 1.5.1). In particular, 'traditional' Aleppo pine feeding sites have been identified throughout breeding and non-breeding habitats. Each season, Eyre Peninsula Yellow-tailed Black-Cockatoos return to these pine stands in both the over-wintering and summer breeding habitats to feed. Site fidelity is also shown for Sugar Gum remnants containing patches of hakea spp, as well as revegetation sites of native food species and in some cases, individual hakea shrubs and Yacca (*Xanthorrhoea semiplana*) stands are revisited along roadsides in the breeding area every summer.

So habitual are Eyre Peninsula Yellow-tailed Black-Cockatoo's feeding patterns that alternative food resources (both Aleppo pines and native foods) may not necessarily be searched for or utilised. During poor seasons and drought years when traditional feeding sites do not produce enough food, breeding pairs have lost chicks to starvation. Nest attendance rates drop the further birds have to travel to the next nearest known food resource, despite alternative but 'unknown' sites occurring nearby. This seeming lack of ability or initiative to search for and utilise alternative food in new locations was highlighted directly after the 2005 fire. Despite the fire burning the entire breeding area, Eyre Peninsula Yellow-tailed Black-Cockatoo were not observed utilising adjacent unburnt habitats during the next breeding season, despite a severe lack of food resources in their traditional breeding and foraging areas.

Both individuals in a breeding pair have been observed foraging together in Aleppo Pines, however whilst feeding in hakeas, and sometimes Yaccas, the male may act as sentinel to guard the female against terrestrial predators such as foxes and cats. As both parents take part in feeding both at nestling and fledgling stages, any missed foraging sessions may disadvantage the chick's development. Juvenile birds stay with their parents until the start of the next breeding season and sometimes until the following breeding season. During this time the young birds learn many important survival skills and behaviours, including the location of reliable feeding sites.

Nest selection is influenced by the location of habituated food resources and habitual nesting behaviour. A close and reliable food resource is critical to a breeding pair's success in raising their chick. All active nests located in the 2003-2004 breeding season were within at least 2 kilometres of a habituated Aleppo Pine food tree (S Way [Department for Environment and Heritage], pers. obs.).

1.5.3 Movements and annual migration

Migration: historical perspective

The idea of annual migration events in Yellow-tailed Black-Cockatoos, such as that proposed by Dawson (1994) has not been adopted due to the speculative nature of much of the information available. The relatively small size of the Eyre Peninsula population has allowed close analysis of its movement, and regular monitoring since the late 1990's has identified where proportions of the population are at certain times.

Current monitoring data confirm that an annual migration for this population does take place over Eyre Peninsula. The population moves directly from their breeding grounds on lower Eyre Peninsula to their winter range approximately 200km to the north-west within about two days. The northward migration usually coincides with the break of the season (late April/early May), with cold southerly winds and wet weather indicating their departure is near. Sightings from Sheringa, Pine Grove and Mt Wedge throughout the 1980's suggest that movement between the northern and southern range was (historically) predominantly along the western edge of Eyre Peninsula (van Weenen and Cooper 2000). Historically, Sheoak Grassy Woodland habitat would have dominated this migration route. Extensive clearing has produced large gaps in native vegetation cover along western EP and the birds are now more exposed to aerial predators (e.g. Wedge-tailed Eagle) whilst migrating.

After approximately six months in the north, Eyre Peninsula Yellow-tailed Black-Cockatoos return to their breeding ground where they remain for the summer. Census counts indicate that by October, fewer birds are observed in the northern part of their range. Reduced counts in the north at this time coincide with the return of birds to the breeding area. The birds usually migrate southwards with the strong northerly winds that start to be experienced around this time.

A lack of historical movement and distribution data of Yellow-tailed Black-Cockatoos on Eyre Peninsula makes it difficult to determine if this migration behaviour is inherent or a developed response to changing environmental conditions. Historically, the requirement to drink regularly may have influenced the distribution and movement of the Eyre Peninsula population. In the past, water was probably more reliable in the creeks and streams of lower Eyre Peninsula, compared to the drier northern part of their range. On close inspection of the northern distribution, the bulk of the area used by the cockatoos is within close proximity to granite inselbergs. Such geological features in the landscape act as effective water catchment sites during the winter. Consequently, this area is one of the few areas of northern Eyre Peninsula that offers such a resource. Rocky outcrop areas further north and west may have been avoided possibly due to less reliable rainfall. Considering Eyre Peninsula Yellow-tailed Black-Cockatoos' tendency to habitually visit the same feeding and watering sites (Section 1.5), the relatively rapid drying of inselberg water resources as temperatures begin to rise may have been a critical factor influencing when the birds left the area.

In the south, it is probable that food resources would have been limiting during winter months, following the summer production and subsequent utilisation of native food resources such as *Hakea* nuts and moth larvae in *Xanthorrhoea* flower spikes (Section 1.6.2).

Movements in the southern range

The breeding status tends to have a strong influence on the local movements of the flock within the breeding area. Breeding pairs tend to temporarily depart from the flock during early November/December and then largely ignore the flocks' movements by late December, when they concentrate on nesting activities. By mid January and February and early March, the breeding pairs tend to utilise small territories that usually contain at least one stand of Aleppo Pines (*Pinus halepensis*).

Non-breeding birds seem to roam in a less predictable fashion throughout the breeding area and surrounding district. During March, they appear to join up with breeding pairs (that may have young in the nest) and spend a vast proportion of their time in the northern end of the breeding area. Birds are rarely seen far south of this area for the remainder of the breeding season.

Before the 2005 fire, the flock (including breeding and non-breeding individuals) tended to congregate at Wanilla Forest and on private land in the north-western periphery of the breeding area twice a year: following the southern migration in October/November and sometimes before the northern migration in April/May. The once-extensive Aleppo Pine stands at Wanilla Forest provided quiet roosting and feeding sites for the birds to prepare for, and potentially recuperate from, migratory flights. Wanilla Forest, including significant stands of Aleppo Pine feed trees were razed in the 2005 fire and although the birds are still being recorded in this western area before and after migration, they are utilising adjacent areas including SA Water's Uley Basin and surrounding properties along the Flinders Highway, south of the Coffin Bay turn off.

Until recently, no birds had been observed in the breeding area over winter. However, observations of at least two individuals in their southern range have been recorded each winter since the 2005 fire.

Movements in northern range

Northern property owners in the area between Wudinna and Port Kenny have been targeted as a source of information on the movements of birds in this area. Winter distribution data collected by landholders and project staff since 1998 have revealed several properties regularly visited by the cockatoos. These properties occur throughout the area of Mount Damper in the east and Mount Cooper in the west (Figure 4) and all contain Aleppo Pines. Similar to their behaviour in the south, Eyre Peninsula Yellow-tailed Black-Cockatoos tend to visit the eastern and western limits of their northern range at different times during the winter. This may be linked to the maturation of Aleppo Pine cones at different sites (van Weenen and Cooper 2000).

Movement data and feeding observations have shown that the birds' movements are largely dictated by the distribution of Aleppo pines throughout farmland in the Mount Damper and Mt Cooper area. In the north, Eyre Peninsula Yellow-tailed Black-Cockatoo flocks tend to forage repeatedly at a particular Aleppo site until the cones are depleted before moving onto neighbouring sites. Larger flocks tend to range more widely as they exhaust Aleppo food resources

quicker and therefore utilise a larger number of sites. Movements and foraging ranges have diminished since smaller flocks have been observed (e.g. 11 birds in 2006). Since 2006, the current flock of 9-11 birds have spent the majority of their time moving between two neighbouring properties at Mt Damper and approximately 1 km apart; Aleppo Pine resources here being adequate to sustain such a small flock for a number of weeks.

1.6 Diet

Eyre Peninsula Yellow-tailed Black-Cockatoos consume a mixture of native and introduced seeds and wood-boring invertebrate larvae.

Analysis of the crop contents of the first specimen ever collected from Eyre Peninsula near Kapinka in 1899 revealed a variety of insect larvae and seeds from within woody cones. More specifically there were six tree boring grubs, four Chrypalids, three Coleoptera and several Hakea seeds.

In the 1997/98 breeding season, a nestling carcass was obtained from a nest within the breeding area. Its crop contents were found to comprise approximately 6gms of seed and insect carcasses (Pedler pers. comm. 1998). The contents were broken down into 4.0gms of Aleppo Pine (approx. 240 seeds – most with husks), 1.5gms of *Hakea* spp. (approx. 125 seeds) and 0.5g of wood boring larvae (13 heads and empty skins).

Although Yellow-tailed Black-Cockatoos on Kangaroo Island and in the Adelaide Hills forage on Radiata Pine (*Pinus radiata*), Eyre Peninsula birds have not been observed feeding on this species. Several species of native pine occur within the range of the EP cockatoo population (e.g. native Southern Cyprus Pine (*Callitris preisi*) or the White Cypress Pine (*Callitris glaucophylla*). Preliminary investigations into native pine in the northern range in May 2000 (coinciding with when the birds arrive from the south) revealed only open cones on trees with no seed available to the birds. Discussions with a landholder who grew up in the area, revealed that he had observed cockatoos eating seed of native pine in the Minnipa area. (Len Starkey, pers. comm. in van Weenen & Cooper 2000)

1.6.1 Seeds

Hakea seed

As with most populations of *C. funereus*, the Eyre Peninsula cockatoos tend to eat seeds that are contained within woody cones. Seeds from the cones of the locally indigenous Wrinkled Hakea (*Hakea rugosa*) and Elm-seed Hakea (*H. cycloptera*) are targeted on Eyre Peninsula (Figure 6).

The cockatoos forage both on large (2m high x 2m wide) and surprisingly small (30cm high x 30cm wide) hakea shrubs (van Weenen and Cooper 2000). Chewed cones and the pruned tips of hakea shrubs are a clear indicator the cockatoos have visited the area (Figure 7 and Figure 8). In addition, the colour of pruned tips provides some indication of how recent a visit has been (with green cuttings indicating a very recent visit).

The Elm-seed Hakea appear less abundant in the cockatoo breeding area on lower Eyre Peninsula compared to Wrinkled Hakea. Elm-seed hakea has much larger cones, which are typically fewer in number compared to Wrinkled Hakea cones (mean number of 115 cones per plant for shrubs <1m in height and 359 for shrubs >1m in height [Way, 2006]).



Figure 6 Eyre Peninsula Yellow-tailed Black-Cockatoo food resources, from left to right, seeds from Elm-seed Hakea, Wrinkled Hakea and Aleppo Pine (Photo: Sarah Way)



Figure 7 Chewed Wrinkled Hakea branchlets **Figure 8 Chewed Elm-seed Hakea cone**

Aleppo Pine seed

Eyre Peninsula Yellow-tailed Black-Cockatoos have responded to the drastic reduction in native food resources by utilising the introduced Aleppo Pine (*Pinus halepensis*). Failure to adapt to alternative food resources such as the Aleppo Pine would have likely resulted in the species' extinction on Eyre Peninsula.

Aleppo Pine seeds are currently the most important food resources for the Yellow-tailed Black-Cockatoo population on Eyre Peninsula. Their reliance on this introduced species as a source of food is evident, particularly in the breeding area. This has presented some challenging management issues because Aleppo Pines are a proclaimed pest plant species in southern Eyre Peninsula under the *Natural Resources Management Act, 2004* (Way, 2006).

Field observations of Eyre Peninsula Yellow-tailed Black-Cockatoo feeding behaviour conducted since 1999 have identified that Eyre Peninsula Yellow-tailed Black-Cockatoos are highly adapted to forage on immature (i.e. green) and un-opened Aleppo Pine cones. Dextrous use of their toes, beak and tongue allows the bird to efficiently strip seeds from each scale of the cone, extracting each seed and discarding the wing and leaving an easily recognizable straggly cone (Figure 9).

Field studies conducted throughout the late 1990s show that Eyre Peninsula Yellow-tailed Black-Cockatoos spend at least 75% of all foraging time feeding on seeds from Aleppo Pine cones in the breeding area (van Weenen and Cooper 2000). More recent pre-fire observations suggest that this figure may be as high as 85-90% for some breeding pairs (J Cooper, pers. comm.).

Considering the loss of Sugar Gum woodland habitat on lower Eyre Peninsula, the presence of Aleppo Pines in the breeding area is likely to be the only way Eyre Peninsula Yellow-tailed Black-Cockatoo pairs obtain enough food resources to raise young. Although not quantified, observations of the birds' foraging behaviour in their winter habitat suggests similar dependence on Aleppo Pines as a major food resource.

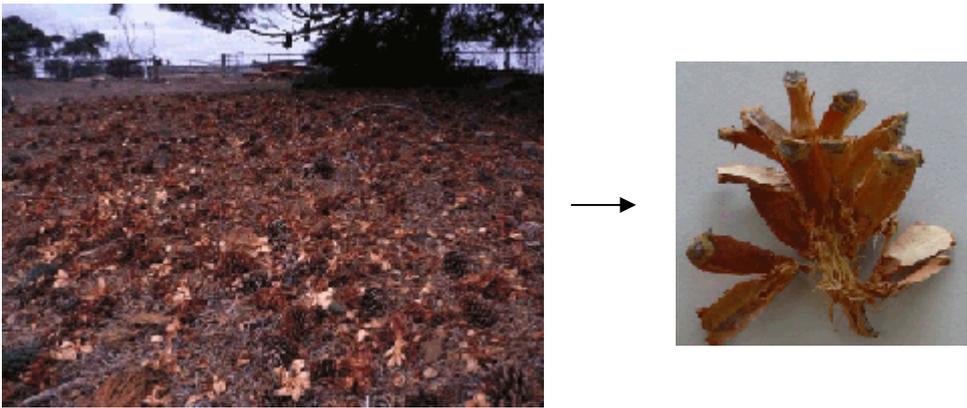


Figure 9 Chewed Aleppo Pine cones, characteristic feeding signs of Eyre Peninsula Yellow-tailed Black-Cockatoos (Photos: Jason van Weenen and Sarah Way)

1.6.2 Aleppo Pine Seeds compared to native seeds as a food resource

Both the nutritional content (quality) as well as the numbers of seeds per cone (quantity) are important considerations when comparing native and introduced EPYTBC food species. To further understand EPYTBC feeding ecology, preliminary research was conducted in 2006 to compare the quality and quantity of introduced and native food resources. For information on nutritional analysis of Cockatoo food, please refer to Way (2007).

To approximate the amount of available food resource Aleppo Pines represent for the YTBC on Eyre Peninsula, the number of seeds per cone and cones per plant on Wrinkled Hakea and Aleppo Pine were investigated. The mean number of Aleppo Pine seeds per cone (n=5) is 235 (Way 2007). The mean number of seeds per plant for both Aleppo Pines and Wrinkled Hakea are shown in Table 1 and Table 2 respectively. A small Aleppo Pine (6-8 m) has over 25 times the amount of cones compared to a large hakea (Tables 1 and 2). An average size Aleppo Pine (8-10 m) has over 1000 times more seed in the top two thirds of its branches (974,524.4) than a whole large size hakea bush (718.6) (Tables 1 and 2).

While not all of the estimated 2,985 cones on a 6-8 m Aleppo will be available simultaneously as EPYTBC food, it is clear that food resource availability in sexually mature Aleppo Pines far exceeds that of a hakea at any one time. These results have significant implications for attempting to replace the food resource availability of one Aleppo Pine food tree with native revegetation. This is discussed further in Section 2.2.3.

Table 1 Mean number of Aleppo Pine cones and seeds pre tree

Height category ¹ (m)	Mean no. cones/tree	Mean no. seeds/tree
6-8	2,985.8	701,060.6
8-10	4,150.4	974,524.4
10-12	6,936.7	1,628,729.3

¹ Three trees were sampled from each size class (n=9)

Table 2 Mean number of Hakea cones and seeds per plant Seeds

Height category ¹ (m)	Mean no. cones ² /plant	Mean no. seeds/plant
<1	115.3	230.6
>1	359.3	718.6

¹ Three plants sampled from each size class (n=6)

² One Hakea cone has two seeds.

1.6.3 Invertebrates

Meyriccia latro moth larvae

In the southern part of their range, the cockatoos extract *Meyriccia latro* moth larvae (Figure 10) from within new Yacca (*Xanthorrhoea semiplana*) inflorescences. Field observations have revealed that as many as 20 larvae can be inside an inflorescence approximately 1 m in height (S. Way *pers. obs.*)

M. latro larvae appear to be a highly favoured food resource for breeding pairs. This may be partly explained by the relatively high protein content of the larvae compared to plant seeds and the apparent ease with which the cockatoos are able to extract larvae from the Yacca spikes (Figure 11 and Figure 12).

The production of inflorescences appears to be greatest where there is reduced tree cover and shading. As a result, the edges of woodland remnants and open heath remnants appear to be most productive. The swarf produced by the moth larvae within the spikes is quite obvious and may be a search cue for the cockatoos when determining inflorescence suitability.

The availability of this food resource is influenced by seasonal conditions. If winter and spring rains are inadequate, the numbers of inflorescences are significantly reduced and in some extreme cases (such as in the 2005-2006 drought), the Yaccas fail to flower. This in turn limits suitable sites for the adult female *M. latro* moth to lay her eggs. Depending on seasonal conditions, this resource is generally exhausted by mid- to late-breeding season when the inflorescences have died and the moth larvae have metamorphosed and vacated the plant.



Figure 10 *Meyriccia latro* moth larvae collected from Yacca flower spikes (Photo: Sarah Way)



Figure 11 Eyre Peninsula Yellow-tailed Black-Cockatoos extracting *M.latro* larvae from Yacca flower spikes.



Figure 12 Eyre Peninsula Yellow-tailed Black-Cockatoo feeding signs on Yacca flower spikes.

Acacia insect larvae galls

In contrast to the *M. latro* larvae, the gall forming larvae found parasitising the Golden Wattle (*Acacia pycnantha*) appear to be consumed by the cockatoos much later in the breeding season. Galls are typically quite small when the birds return to the breeding area. Over summer the galls increase in size and the cockatoos target them primarily during February and March (Figure 13).

Like Yacca flowers, the growth and abundance of galls can vary quite considerably on an annual basis and in response to seasonal conditions.



Figure 13 Large galls on Golden Wattle from which borers are extracted.

Wood-boring insect larvae

Eyre Peninsula Yellow-tailed Black-Cockatoos forage on wood-boring insect larvae found beneath the bark of Sugar Gum (*Eucalyptus cladocalyx*) in the summer southern range.

With Sugar Gums, cockatoos chew the bark off at various levels of the tree trunk, with some individuals being observed walking up to the base of the tree and beginning to remove bark. The thick nature of the bark suggests that accessing larvae from Sugar Gums is possibly a more difficult exercise. The area chewed is distinctive in appearance with gouge marks in the surrounding bark and fresh portions of bark on the ground (Figure 14 and 15). Eyre Peninsula Yellow-tailed Black-Cockatoos were first observed foraging for wood-boring larvae in mallee near Minnipa, north-central Eyre Peninsula in 2000 (van Weenen and Cooper 2000). This provided the first record of a native food in the cockatoos' northern range and the first record of Yellow-tailed Black-Cockatoos anywhere in Australia utilising mallee in this way. Several species of mallee contained borers upon which the cockatoos foraged, including Yorrel (*E. gracilis*), Yellow Mallee (*E. incrassata*), and Coastal Mallee (*E. diversifolia*) and White Mallee (Yorrel) (*E. gracilis*). Closer inspection of the mallee limbs revealed the birds had tracked the borers along the length of the limbs to find the larvae. The length of individual chewings varied from 3cm to 70cm along the branches (Figure 15). In addition to fresh chewings, there was clear evidence of where the cockatoos had foraged in the previous years, often in the same tree alongside the fresh chewings (van Weenen and Cooper 2000)

Yellow-tailed Black-Cockatoos have been observed in Sheoak (*Allocasuarina verticillata*) woodland remnants on Eyre Peninsula, where they have also been observed foraging on wood-boring insect larvae (Jason Van Weenen, Department for Environment and Heritage, pers. obs.)



Figure 14 Sugar Gum trunk showing bark chewings by cockatoos in order to access the wood boring larvae underneath.



Figure 15 White Mallee with cockatoo chewings from which larvae have been removed.

1.7 Habitat

1.7.1 Southern range

Historically, there were three main vegetation communities throughout the birds' current southern range: Sugar Gum woodlands and heathy woodlands, heathlands (typically on hill tops and ridges) and water courses characterised by Eyre Peninsula Blue Gum woodland (*E. petiolaris*) and/or swamp habitats. It is possible that the cockatoos may have also ranged more widely and historically utilised Sheoak (*Allocasuarina verticillata*) Grassy woodlands that have largely been cleared on Eyre Peninsula. The ironstone soils of Southern Eyre Peninsula are agriculturally productive and the majority of these vegetation communities in the region were historically cleared for cropping and sheep grazing (Figure 5).

Today, the remaining habitat reflects the characteristics of such land use and consists of fragmented Sugar Gum remnants and roadside vegetation, all of varying quality and ranging in size from a couple of hectares to approximately 300 Ha (Figure 16). The southern range includes a relatively small breeding area within the Koppio Hills. The core breeding area is approximately 38 km². The principal vegetation community is Sugar Gum woodland, which is recognised as a threatened vegetation community on Eyre Peninsula (DEH 2002). All breeding habitat is contained in remnant vegetation on private land. There is one Heritage Agreement (60.6Ha) in the breeding area (DEH Environmental GIS August 2008).

There are several parks and reserves administered by the Department for Environment and Heritage within the southern range including Tucknotts Scrub, Wanilla Land Settlement Reserve, Wanilla Conservation Park and Lincoln Conservation Reserve. Despite providing protected remnant heath and Sugar Gum habitat, the Yellow-tailed Black-Cockatoos tend to utilise private land remnants for feeding and particularly nesting compared to these areas. Field assessments have identified that the size and/or age of the Sugar Gums present in some of these parks and reserves are not conducive to providing hollows suitable for cockatoo nests.

The entire breeding area and the majority of peripheral Sugar Gum woodland habitat in the southern range were burnt during the 2005 fire. For more information on fire impacts on the southern habitat, see Section 2.2. Before the 2005 fire, many remnants exhibited a lack of understorey diversity and recruitment and some species (e.g. Golden Wattle *Acacia pycnantha*) were close to climax stage while others (e.g. *Hakea* spp.) were senescing.

Other areas of importance include the Red Gum woodlands and Mallee heaths of the Uley, Lincoln and Uley-Wanilla basins, administered by SA Water. Ten Aleppo Pine feeding sites have been identified in the Uley-Wanilla basin. These sites are of particular importance as they escaped the 2005 fire and provide potentially important food resources. Wanilla Forest, administered by the Aboriginal Lands Trust represented a critical Aleppo Pine feeding site before the 2005 fire, as well as a pre- and post-migratory congregation site for the population (Section 1.5.3).

Aleppo Pine stands are an important habitat component across the southern range and provide a critical food resource for the cockatoos. Aleppo Pines were introduced to Eyre Peninsula by the forestry industry in the early 1800s. Aleppo Pines grew quickly and responded well to Eyre Peninsula's calcareous soils and Mediterranean climate (annual rainfall of 300-600 mm). Being quite a large and fast-growing species, Aleppo Pines proved ideal for windbreaks around farmhouses and buildings, as well as stock shelterbelts. Consequently, Aleppo Pines were widely planted on Eyre Peninsula by early settlers and later throughout the soldier settlements after World War Two. Aleppo Pines were still recommended for this purpose by the Department for Agriculture up until the mid 1980s. They are now a proclaimed pest plant species on Southern Eyre Peninsula under the *SA Natural Resources Management Act, 2004*. Historically, some Aleppo pines were also planted as a symbol of the "Lone Pine" at Gallipoli beach and in remembrance of Australian World War Two troops.

1.7.2 Northern Range

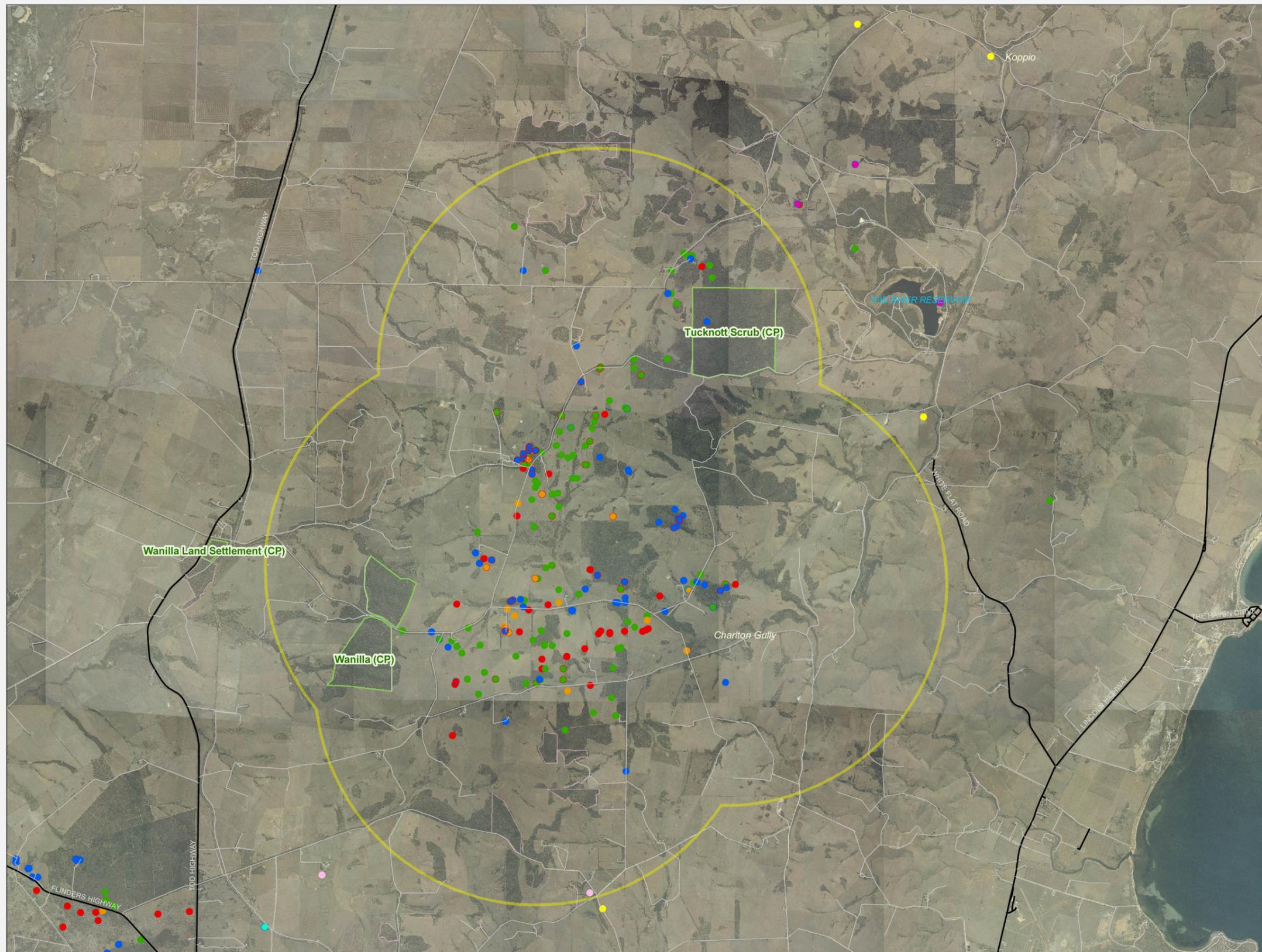
As in the southern range, Aleppo Pines are also a critical habitat component in the north. During the winter, Eyre Peninsula Yellow-tailed Black-Cockatoos forage almost exclusively on Aleppo Pine cones from trees on farming properties and the birds' movements and use of the area are largely determined by this feeding behaviour.

The farming properties in the northern range are generally more extensively cleared compared to the southern habitat and the cockatoos often have to move across large tracts of cleared cropping land. As in the south, mallee remnants along roadside provide important feeding sites and corridors across the landscape.

The vast areas of mallee habitat protected in Kulliparu Conservation Park (13,590Ha) and Conservation Reserve (31, 413 Ha) also provide good cover and protected flight paths between Aleppo pine resources in Mount Cooper and Mount Damper (Figure 17). Kulliparu also provides native food resources such as wood-boring larvae in mallee eucalypts (Section 1.6.2) and protected roosting sites. The winter flock often retreats and/or remains in Kulliparu during periods of bad weather instead of venturing out into exposed farmland to feed on Aleppo pines (S.Way, *pers. obs.*)

There are a variety of mixed Mallee communities on north-western Eyre Peninsula including Mallee-box (*Eucalyptus porosa*) woodlands, White Mallee (*E. dumosa*)/Coastal White Mallee (*E. diversifolia*) over Broombush (*Melaleuca uncinata*) and Yorrell (*E. gracilis*)/White Mallee/Red Mallee (*E. socialis*) over Dryland Tea-tree (*Melaleuca lanceolata*) associations. These mallee communities occur in Kulliparu, as well as two different hakea species, Elm-seed Hakea and Heath Needlebush (*H. muelleriana*) (Brandle 2000). A lack of field observations has failed to confirm whether the cockatoos feed on the cones of the Heath Needlebush.

Figure 16 Aerial photography of fragmented habitat remnants in the Eyre Peninsula Yellow-tailed Black Cockatoo core breeding area



Eyre Peninsula Yellow-tailed Black-Cockatoo

Activity

- Breeding
- Feeding

Year of sighting

- 1899
- 1909
- 1930 - 1940
- 1935
- 1970 - 1998
- 1972
- 1983 - 1984
- 1989
- 1989 - 1993
- 1993 - 2001
- 1994 - 1998
- 1996 - 2001
- 1998 - 1999
- 2000 - 2001
- 2002 - 2003
- 2004 - 2005

5km buffer zone around outer most EPYTBC breeding sites

NPWSA Reserves

- Conservation Parks
- Conservation Reserves
- National Parks
- Recreation Parks
- Wilderness Protection Areas
- Vegetation Heritage Agreements
- Roads



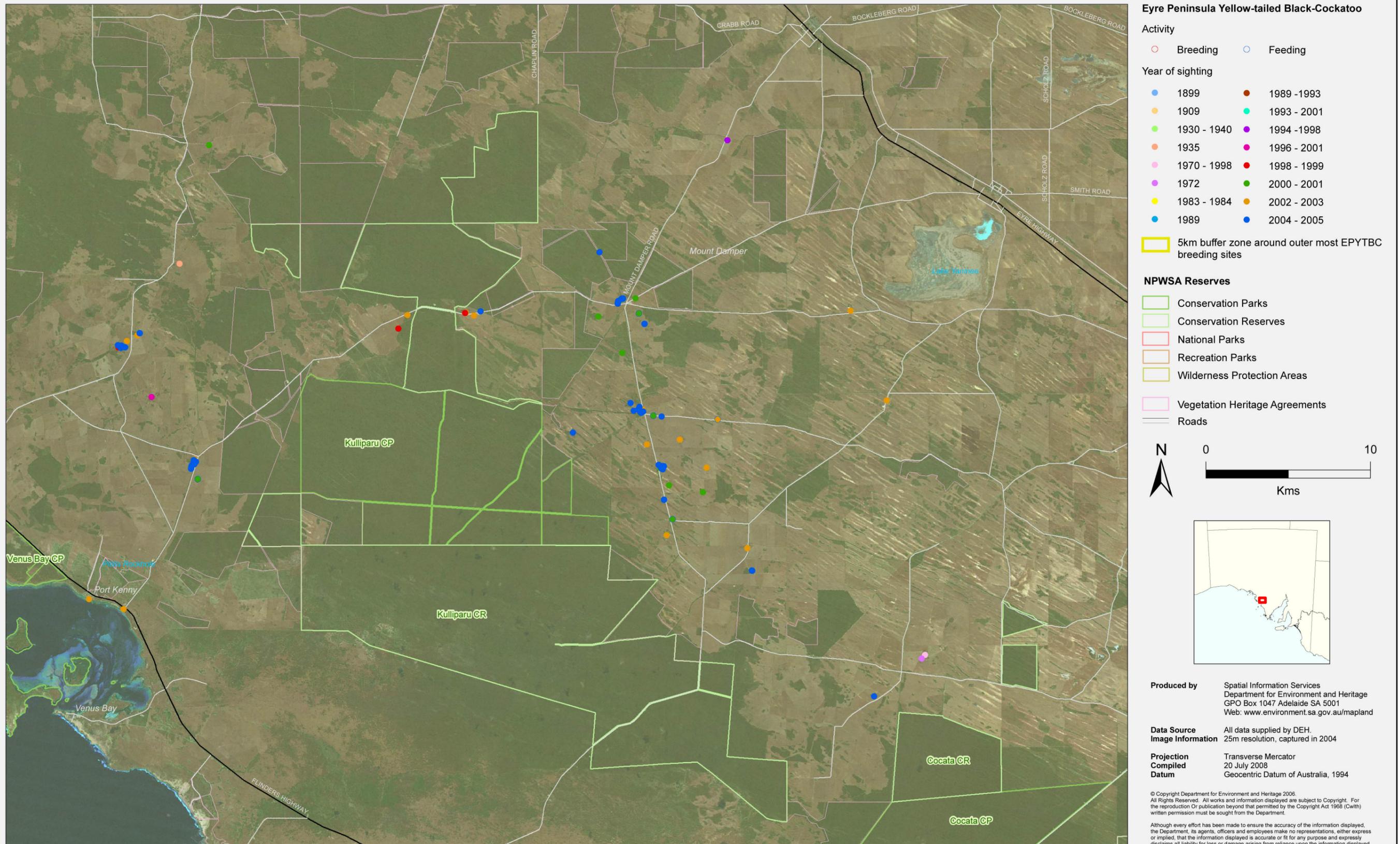
Produced by Spatial Information Services
 Department for Environment and Heritage
 GPO Box 1047 Adelaide SA 5001
 Web: www.environment.sa.gov.au/mapland

Data Source All data supplied by DEH
Image Information 1m resolution, captured in 2004

Projection Transverse Mercator
Compiled 20 July 2008
Datum Geocentric Datum of Australia, 1994

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Figure 17 Satellite imagery of fragmented habitat remnants in the Eyre Peninsula Yellow-tailed Black Cockatoo northern habitat range



1.8 Habitat critical for survival

The Sugar Gum Woodland and heathlands of the Koppio Hills as well as certain Aleppo Pine stands have been identified as the habitat critical for Eyre Peninsula Yellow-tailed Black-Cockatoo survival.

Essential Sugar Gum woodland habitat components include:

1. Hollow-bearing Sugar Gum trees.

Hollows suitable for use by Yellow-tailed Black-Cockatoos need to have an entry circumference of at least 18cm. Hollows this size generally takes between 50-200 years to develop (Saunders *et al* 1982). Development of suitable hollows can be influenced by insect attack, fire frequency and intensity and wind damage (further exposing to insect attack). Soil quality may also influence hollow development, and smaller, stunted Sugar Gums growing on poorer quality soils may not bear suitable hollows.

2. Productive heath communities.

Diverse heathlands with predominance of native food resources such as Wrinkled Hakea, Elm-seed Hakea and Yacca in understorey vegetation. A diverse mixture of species maximises resource availability, particularly as some food resources can vary considerably throughout the year.

3. Structural diversity of vegetation.

A high variety of vegetation structures allows for a mosaic of species assemblages (e.g. open heathy areas favouring flowering Yaccas) and increases availability of roosting, feeding and nesting sites.

4. Aleppo pines in close proximity to nesting sites.

Aleppo pines remain a critical habitat component for Eyre Peninsula Yellow-tailed Black-Cockatoos at least until native food resources are replaced and established in the breeding area to a degree that will sustain the population. Following the loss of 69% of Aleppo Pines in the breeding area during the 2005 fire, all remaining Aleppo Pines in the breeding area and in a five kilometre buffer around the currently known Eyre Peninsula Yellow-tailed Black-Cockatoos breeding area have been identified as habitat critical for survival (Way 2006).

It is still unclear what constitutes a preferred Aleppo Pine feed tree to an Eyre Peninsula Yellow-tailed Black-Cockatoo. Field observations have shown that selection occurs both within and between stands of Aleppo Pines in both the southern and northern ranges (van Weenen and Cooper 2000). Differences in the structural form of Aleppo Pine utilised have also been noted. In the northern habitat, spindly, individual trees as short as 2-3 metres have been used while pines selected in the breeding area tend to be large (at least 6 metres high) with ample, dense canopies (*S. Way pers. obs.*). More research is required to understand the selection of Aleppo Pine feed trees by Yellow-tailed Black-Cockatoos.

Other considerations include:

5. Optimum proximity of nest sites to food and water resources.

Field studies have revealed that nest sites are generally within 1-2km of an Aleppo Pine feeding site and/or native food resources and watering points. The further a breeding pair has to travel to forage decreases the frequency of feeding visits bestowed on the chick.

6. Remnant size and degree of connectivity

Larger remnants do not always represent optimum habitat. The ability of a remnant to provide habitat critical for Yellow-tailed Black-Cockatoos depends on many factors including size and quality. The occurrence of the above important habitat components are more important than size alone. For example, nest monitoring data and associated mapping has shown that small degraded remnants with little understorey but high frequency of hollow-bearing Sugar Gums have provided important nesting habitat when adjacent to better quality remnants providing native food or Aleppo Pine feeding sites. The degree of connectivity of a particular remnant to others containing more of the same or additional critical habitat components may influence its use by cockatoos.

1.8.1 Identification of critical habitat

The entire breeding area consisting of Sugar Gum Woodland remnants throughout the Koppio Hills is critical habitat for the Yellow-tailed Black-Cockatoo on Eyre Peninsula. Key areas include farming properties bordered by Proude Gully Road in the south, Reservoir Drive in the north, Charlton Gully Road in the east and Toolillie Gully Road in the west (approximately 38km²)

Aleppo Pines occurring in the breeding area are also considered critical habitat, along with 10 Aleppo Pine feeding trees identified in Uley-Wanilla Basin (Way 2006).

In the northern range, critical habitat includes the area between Mt Cooper in the north, Mount Damper in the west, Kulliparu Conservation Reserve in the south and Colley in the east (approximately 1,116 km²). Aleppo Pines and mallee remnants on farming properties in the Mount Damper and Mount Cooper regions are also considered critical habitat, particularly along Moonlight Flat, Mt Damper, Tarragon Tanks and Cooblee Roads and the Port Kenny Road between Wootoona and Colley Hill.

Critical habitat along the north-south migration route has not been identified due to a lack of field data. Historical observations suggest that the birds fly slightly inland of the western coast of Eyre Peninsula. Areas such as Sheringa and Mount Wedge (inland from Elliston), may provide important feeding and roosting sites during the annual migration.

1.8.2 Habitat mapping

Data collected on the birds' movements, feeding and nesting sites since 1998 have provided the basis for critical habitat mapping (Figure 2, Figure 3 and Figure 4). All known nests sites occur on private land and have been mapped but are not displayed in this plan for conservation and privacy reasons.

Based feeding and nesting location data, a buffer of critical habitat extending 5km out from the core breeding area (Figure 18) was established during Aleppo pine mapping in 2006 (Way 2006). Known or potential Aleppo Pine feed-trees in, and adjacent to, the Yellow-tailed Black-Cockatoo breeding area were also mapped following the 2005 fire (Figure 18).

1.8.3 Consultation with habitat managers

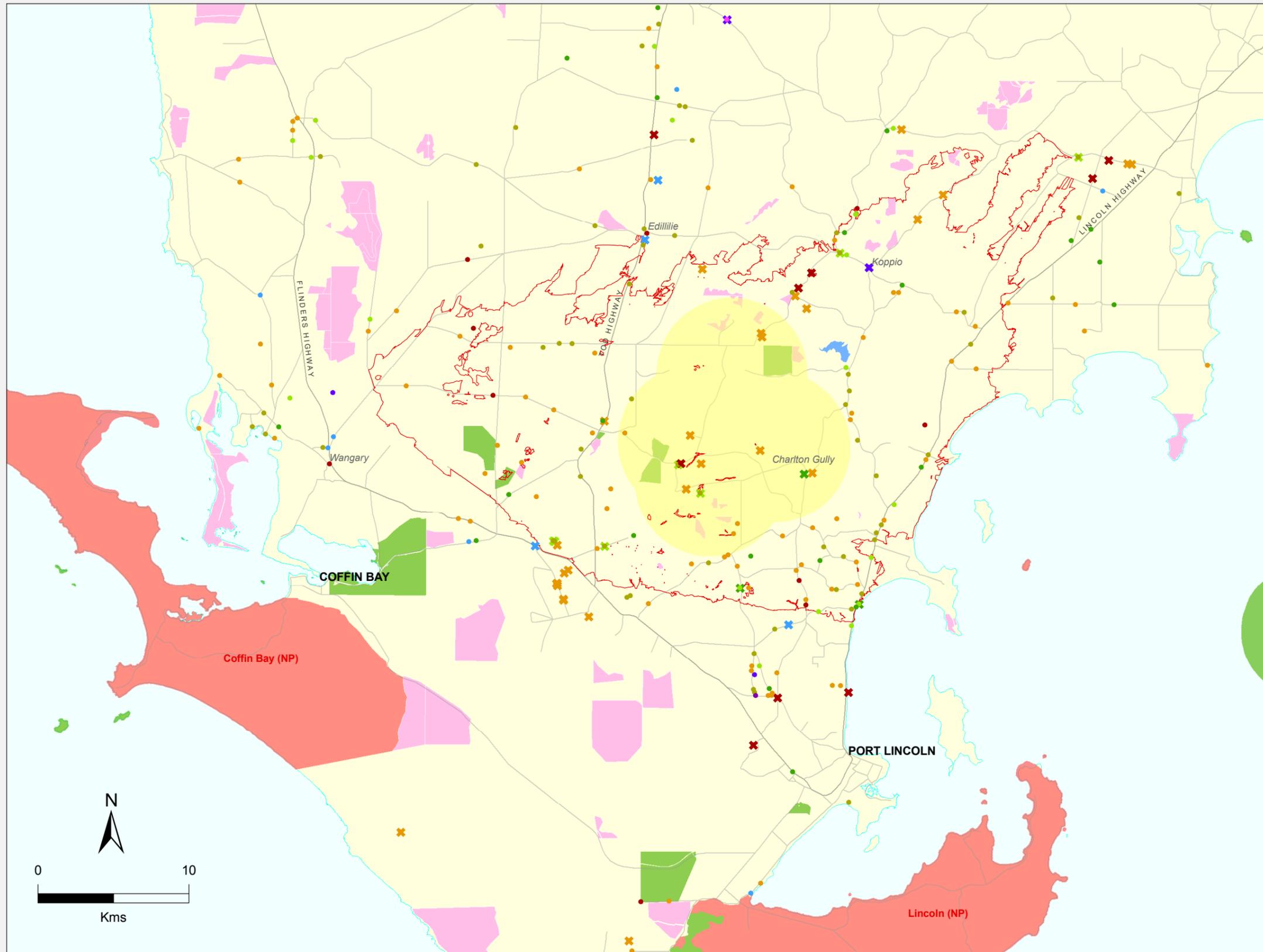
Local landholders are the main land managers of Yellow-tailed Black-Cockatoo critical habitat on Eyre Peninsula. Other land managers are listed in Table 3.

Table 3 Overview of managers of critical Yellow-tailed Black-Cockatoo habitat on Eyre Peninsula.

Land manager	Critical habitat	Other habitat
Local Eyre Peninsula landholders	Breeding area & northern range	Annual migration path. Areas adjacent to critical habitat.
SA Water	Uley-Wanilla Basin	Lincoln Basin Uley Basin
Department for Environment and Heritage	Kulliparu Conservation Park and Conservation Reserve	Lincoln National Park Lincoln Conservation Park Kathai Conservation Park Tucknott Scrub Conservation Park Wanilla Conservation Park Wanilla Land Settlement Conservation Park Murrunatta Conservation Park & Conservation Reserve Kellidie Bay Conservation Park
Local government (District Councils of Tumby Bay and Lower Eyre Peninsula, Wudinna, Streaky Bay and Ceduna)	Remnant vegetation and Aleppo Pines along roadside in the southern and northern ranges.	
Port Lincoln Aboriginal Community Council, Aboriginal Lands Trust	Wanilla Forest	

Consultation has been undertaken on a number of levels, but most successfully on a face-to-face basis, particularly when dealing with local landholders. Consultation aims to inform land managers about cockatoo ecology and recovery thereby increasing their ability to appropriately manage Yellow-tailed Black-cockatoo habitat on their land. Such consultation has been supported in a number of ways including regular "Threatened Fauna Update" newsletters, workshops, field days, media articles, specific meetings and technical support in the form of letters and reports.

Figure 18 Aleppo Pine feed trees in the southern breeding area



Aleppo Pine Sites

EPYTBC Feeding	Number of Pines
✕	Unknown
✕	1 - 10
✕	11 - 30
✕	31 - 50
✕	51 - 100
✕	101 - 200
✕	201 - 300
✕	>300
✕	>1000

5km buffer zone around outer most EPYTBC breeding sites

NPWSA Reserves

- Conservation Parks
- Conservation Reserves
- National Parks
- Recreation Parks
- Wilderness Protection Areas

Fire Boundary January 2005

- Roads
- Vegetation Heritage Agreements
- Tod River Reservoir



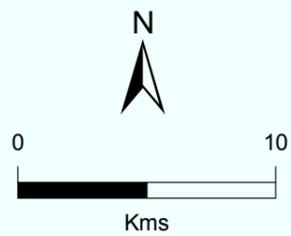
Produced by Spatial Information Services
 Department for Environment and Heritage
 GPO Box 1047 Adelaide SA 5001
 Web: www.environment.sa.gov.au/mapland

Data Source All data supplied by DEH.

Projection Transverse Mercator
Compiled 20 July 2008
Datum Geocentric Datum of Australia, 1994

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2 THREATS

2.1 Biology and ecology relative to threats

Many aspects of Eyre Peninsula Yellow-tailed Black-Cockatoo ecology exacerbate the impact of threatening processes on this population. A declining and isolated population in a fragmented landscape is highly vulnerable to stochastic events. The apparent inability of the wild population to search out and utilise alternative suitable habitat and food resources across Eyre Peninsula aggravate the negative impacts of habitat fragmentation.

2.2 Threatening processes

2.2.1 Habitat fragmentation

The fragmentation of vegetation is a serious issue for the Eyre Peninsula Yellow-tailed Black-Cockatoo. Negative impacts of fragmentation are exacerbated by the fact that the Eyre Peninsula population is isolated from other SA populations, extremely habituated to a small habitat range and represents the western extent of the species' national distribution. Fragmentation and these ecological factors also effect the degree other threatening processes listed below impact the population.

These factors also influence to what degree other threatening processes impact the population

The birds are reluctant to travel over cleared land (Saunders 1977 & J. van Weenen, *pers. obs.*) because it increases their vulnerability to birds of prey (e.g. Wedge-tailed Eagles).

Saunders (1977) also found that White-tailed Black-Cockatoos (*C. latirostris*) experienced reduced breeding success in highly fragmented landscapes in comparison to those less fragmented. Reduced breeding success was attributed to increased effort required to find sufficient food. The highly fragmented nature of the breeding area on lower EP suggests that there are likely to be similar issues facing this population. Depending on their size, fragmented patches also suffer degradation from edge effects (e.g. weed invasion, pesticide spray-drift).

Fragmentation of Yellow-tailed Black-Cockatoo habitat contributes to other threatening processes consequently making the population

2.2.2 Habitat degradation and loss

Since European settlement, 55% (2,783,000Ha) of native vegetation has been cleared from Eyre Peninsula primarily for agricultural development (DEH 2002). The loss of specific vegetation communities is shown in Figure 5. Remaining habitat fragments have also been severely altered by a range of processes including edge effects, salinity, erosion and grazing. Invasion by introduced plants such as Black Wattle (*Acacia mearnsii*) and Bridal Creeper (*Asparagus asparagoides*) can out-compete native species and reduce recruitment, floristic diversity and structure of habitat remnants.

Habitat is also lost, albeit temporarily, by wildfire (see Section 2.2.4). Of the 24 known nest trees, 16 (67%) were destroyed and while fire can sometimes facilitate hollow development, intensive fires can totally destroy whole cohorts of older trees of hollow-bearing size and age leaving a deficit of hollows for many years. Fire also causes the temporary loss of food resources.

2.2.3 Lack of food resources

A number of processes have resulted in a critical lack of food resources in the cockatoo's breeding area. The primary depletion was extensive habitat clearance following European settlement (Section 2.2.2).

However, subsequent removal of cockatoo food plants by livestock has also reduced the amount of native food (particularly in habitats of the breeding area). *Xanthorrhoea*, *Banksia*, and *Hakea* species are susceptible to grazing and in many areas are now confined to roadside vegetation or fenced habitat remnants. This perpetual depletion of native food resources has resulted in the cockatoos' increased reliance on introduced species such as Aleppo Pines

To further exacerbate the depletion of habitat remnants, the 2005 fire had disastrous consequences on food resources: 69% of Aleppo pine resources in the breeding area were destroyed and all but one revegetation site was burnt to varying degrees.

Way (2007) investigated the equivalent area of Hakea revegetation needed to replace the food availability of a row of ten medium-sized Aleppo Pine feed trees. If revegetation was solely Wrinkled Hakea, 1.77 Ha would be required. If a more natural reproduction of Sugar Gum woodland species was revegetated (based on 5% Hakea in the planting mix) a much larger area of 35.4Ha would be required (Way 2007).

2.2.4 Change of fire regimes and wildfire

Fire frequency and intensity has drastically changed following European settlement on Eyre Peninsula. Fire is required for the reproduction of many species in the Sugar Gum woodland community. Prior to the 2005 fire, many of the heathy understorey species in remnant Sugar Gum habitats in the Koppio Hills were senescing and recruitment of important food species such as hakea and Yacca was notably absent (Way and Bates, 2005). Ecological burns were being considered as a management tool to address poor recruitment in some larger habitat remnants.

The priority containment of natural fire events since settlement results in a lack of recruitment for some species and a near senescing understorey. Fuel loads may also increase over time leading to more intense fire events when a fire does occur. It is unlikely that ecological burns or more frequent smaller wildfires would have lessened the devastating impact of the 2005 fire, as the weather conditions and fire behaviour were so extreme.

The 2005 fire burnt almost the entire breeding area and southern habitat range of Eyre Peninsula Yellow-tailed Black-Cockatoos (Section 1.7.1). During the days and weeks immediately following the fire, 43 Eyre Peninsula Yellow-tailed Black-Cockatoo observations were recorded. Of these, only four were in new areas (one near Duck Ponds and three in Port Lincoln including at the Race Course on Proper Bay Road and in scrub near New West Road and the Marina) and two were in areas that the birds had not visited for about ten years (west of Flinders highway and Fishery Bay Road). Generally, the Eyre Peninsula Yellow-tailed Black-Cockatoo population remained in the burnt breeding area until they left for their usual winter migration. The fact that they returned and bred in the core breeding area the very next season after the fire highlights how habituated this population is in their habitat use.

Australian flora has evolved with wild fire. Mass germination and regeneration of early colonizing species can cause short term changes in the composition and structure of a habitat remnant, potentially making the habitat unsuitable for certain fauna species for many years. Regenerating vegetation is also vulnerable to new weed invasions following a wildfire.

2.2.5 *Phytophthora cinnamomi*

Phytophthora cinnamomi (*Pc*) is a soil-borne fungus that attacks and kills many species of native vegetation in southern Australia. Non-alkaline soils are particularly susceptible to infection and once a site is infected, there is no cure and hygiene procedures are required to mitigate further spread. Non-alkaline soils are prevalent throughout the Koppio Hills and *Pc* is suspected to occur at least two sites in (Tucknott's Scrub), and adjacent to (Wanilla Forest), the breeding area. A hygiene station and interpretive signage has been installed at Tucknott's Scrub and access is restricted during winter in sections of Wanilla Forest to try and contain the infection.

Pc is very easily spread in wet soil from boots, cars, and works equipment (e.g. bulldozers, graders, shovels, augers etc). Illegal wood collection involving off-track driving, road grading and revegetation are all activities that have the potential to spread *Pc* in the breeding area. Efforts have been made to run regular workshops on *Pc* awareness and hygiene practices for landholders and land management stakeholders (E.g. SA Water, Eyre Peninsula Natural Resources Management Board, local Councils, SA Water and other State agencies).

2.2.6 Predation

Several pairs of Wedge-tailed Eagles (*Aquila audex*) have territories which overlap with the cockatoos' breeding area. Wedge-tailed Eagles frequently harass the breeding flock during the summer and have been observed attacking individual birds on the wing (S.Way pers. comm. with S. Scholz, Koppio landholder). The omnivorous Common Brushtail Possums (*Trichosurus vulpecula*) eats Yellow-tailed Black-Cockatoo eggs and it is also suspected that the introduced Black Rat (*Rattus rattus*) may also predate cockatoo eggs (S.Way pers. obs.).

Yellow-tailed Black-Cockatoos are vulnerable to feral cat (*Felis catus*) and Red Fox (*Vulpes vulpes*) predation whilst feeding close to the ground on low-growing Hakea shrubs or drinking from dams and water courses.

2.2.7 Nest hollow competition

Galahs (*Elophus (Cacatua) roseicapillus*) have adapted well to the modifications of the Australian environment since European settlement and are one species of native wildlife that can become over-abundant. Many Sugar Gum hollows throughout the Koppio Hills are occupied by Galahs. Although a significantly smaller bird compared to a Yellow-tailed Black-cockatoo (35cm compared to 65cm), Galahs utilise the same sized hollows and have been observed nesting in the poly-pipe cockatoo nest boxes (S.Way pers. obs.). The Galah breeding season is variable, but generally begins in August and finishes just as the cockatoos begin to breed around December. Despite this seemingly partitioned timing of breeding effort, Galah pairs will guard a nest hollow all year round and destroy the nest preparation and eggs of any other bird attempting to nest in their hollow.

Feral European Honeybees (*Apis mellifera*) use hollows that would otherwise be suitable for Yellow-tailed Black-Cockatoos. They may also exclude cockatoos from suitable hollows by aggressively protecting a hive in the same tree. Once established, feral bee hives can be active for 20-50 years, essentially removing that hollow as a resource for other native species.

Common Brushtail Possums also compete with Yellow-tailed Black-cockatoos for similar sized tree hollows for den sites. Possums may utilise several different nest hollows throughout their home range, which varies from 2.5-5ha (Russell 1984).

2.3 Other impediments to recovery

2.3.1 Pathogens and disease

The small size of the existing Yellow-tailed Black-Cockatoo population on Eyre Peninsula increases the threat of extinction from an aggressive pathogen or disease outbreak.

2.3.2 Challenges of community engagement

The majority of Yellow-tailed Black-Cockatoo habitat occurs on private land. Protection of both nesting and feeding habitat is largely dependant on the involvement of landholders. The success and outcomes of on ground works is influenced by the willingness of landowners to approve or become involved in onground works such as fencing, site preparation, weed control, revegetation, nest box installation.

3 EXISTING *IN SITU* CONSERVATION MEASURES

3.1 Recovery Team

A recovery team for the Eyre Peninsula Yellow-tailed Black-Cockatoo was established in 1998, drawing on professional expertise from the Department for Environment and Heritage, Gorge Wildlife Park, Adelaide Zoo, Nature Foundation SA and, at a later date, the Eyre Peninsula Natural Resources Management Board.

The Recovery Team meets at least three times per year at either Port Lincoln or Adelaide. Meetings are held to coincide with the end of the breeding season (March/April), after the winter migration and population census (July/August) and at the commencement of the breeding season when the birds return to southern Eyre Peninsula (October/November).

The Recovery Team discuss and review monitoring results, methods, recovery actions and outcomes. The conservation measures discussed below are considered by the Recovery Team to be primary recovery actions.

3.2 Nest monitoring program

3.2.1 Nest location and mapping

Since 1998, nest searches have been conducted at the start of the breeding season (November and December) to try and identify nest sites used by each breeding pair.

Remnants with known nest sites are monitored at dawn and dusk to detect Yellow-tailed Black-Cockatoo activity. Visits and direct discussions with various landholders also help to identify early cockatoo breeding activity.

Department for Environment and Heritage staff and project volunteers also conduct targeted "nest watch" evenings. Participants are paired up and observe a particular remnant from strategic highpoints to help pinpoint cockatoo activity and/or nest locations. Communication between observer pairs is via portable GRN radios or SMS text messaging.

Once a new nest is located, the GPS location is recorded for mapping purposes and the following details added to a nest database):

1. Nest name
2. Date found
3. Type of nest (hollow or poly-pipe nest box)
4. Seasons active
5. GPS location (datum UTM, WGS84)
6. Landholder/description of location

Where possible, the breeding pair is identified (band resights or observation of unique morphological markings). If a known nest is re-used, the history for that nest is updated (e.g. season active and identification of the breeding pair).

Since 1998, 48 active nests have been located throughout the Koppio Hills, the majority (42, 87.5%) were natural hollows in Sugar Gums and six (12.5 %) were poly-pipe nest boxes (Appendix A).

Thirty-seven artificial nest boxes (32 poly-pipe, four wooden and one barrel) have been installed in the breeding area. The majority were installed following the 2005 fire when 19 poly-pipe nest boxes (donated by Rotary Australia's 'ROBIN' nest box program) were installed throughout the breeding area to replace the loss of 17 nest sites (Appendix A).

3.2.2 Nest protection and maintenance

Nest protection is tackled at two levels, firstly by protecting the actual nest tree, nest box or hollow and secondly, aiming to protect the entire nesting remnant from grazing impacts through fencing. Protection of nesting remnants is discussed further in Section 3.8.

Each nest tree is fitted with a corrugated iron tree guard to protect against Common Brushtail Possum access and predation. The guard is fitted around the perimeter of the tree so that the

bottom edge is not less than 1m from the ground and the guard extends at least 1.5m up the trunk of the tree. If necessary, branches of the nest tree and/or neighbouring trees are trimmed so possums cannot access the nest tree via any overlapping canopy. Trimming is often not possible for logistical reasons and tree guards may also need to be fitted to trees adjacent to the nest.

Annual maintenance of known nests and nest boxes involves:

1. Checking and adjusting tree guards.
2. Destruction of European Honeybee hives in nest trees or in trees adjacent to nest trees to ensure safe working and climbing conditions.
This is done using Coopex®, a non-residual insecticidal dusting powder. The active ingredient in Coopex is permethrin. Permethrin is a synthetic form of pyrethrum and is also the active ingredient in *Excelpet* flea collars. Flea collars have been used successfully to deter bees in poly-pipe nest boxes as part of the Glossy Black-Cockatoo project on Kangaroo Island and are easily removed from nest boxes just before the breeding season (Trish Mooney, Bush Management Advisor, DEH, *pers. comm.*)
3. Removal of other species' nesting material (e.g. European Starling, Galah).
4. Checking and topping up red gum bark chips in poly-pipe nest boxes.
5. Checking structural integrity of nest hollows and poly-pipe nest boxes and repairing where possible.

3.2.3 Chick monitoring

In the 1997/1998 breeding season, all Eyre Peninsula Yellow-tailed Black-Cockatoo chicks died in the nest (van Weenen and Cooper 2000). This was an unacceptable outcome for the conservation of this species. The next season (1998/1999), the Recovery Team decided to conduct a hand-rearing trial in captivity to detect any abnormal physiological factors that may inhibit chick growth. These trials, conducted by staff of the Gorge Wildlife Park, revealed that hand-raised chicks tended to have slower initial growth, but gained weight comparably to wild chicks thereafter (van Weenen and Cooper 2000).

No abnormal physiological conditions were detected during these trials. A complementary field investigation of chick growth and survivorship in the wild breeding population was also conducted in the 1998/1999 season. This study revealed that chick growth was influenced by the feeding frequency of parent birds (van Weenen and Cooper 2000). These results reflected an earlier study by Saunders (1977) on Western Australia's White-tailed Black-Cockatoo (*C. latirostris*). Saunders linked chick growth and survival not only to feeding frequency, but also to other factors such as food availability and degree of habitat fragmentation. It was clear that long-term nest monitoring was needed to fully understand the conditions required for successful breeding.

Monitoring of chick development, growth and fledging provides important breeding success and recruitment data for the Eyre Peninsula population. Breeding success of the Eyre Peninsula population is shown in Figure 19, where *successful* is defined as a nest producing a confirmed fledged chick.

Ongoing nest monitoring has also confirmed reasons for nest failure. The main causes of nest failure are:

1. Infertile eggs
2. Nestling starvation
3. Predation by Brushtail Possum
4. Interrupted incubation of fertile eggs - presumably by inexperienced pairs
5. Egg damage presumably caused by the adult birds (nest subsequently abandoned)
6. Damage to nest chamber, e.g. flooding of the nest chamber during heavy rains

The frequency of occurrence of these causes of nest failure since 2004 is shown in Figure 20. Mortality refers to when a nestling was found dead prior to fledging.

Figure 19 Breeding success of the Eyre Peninsula Yellow-tailed Black-Cockatoo since 1998.

NB: No wild breeding was observed in the 2007/08 season

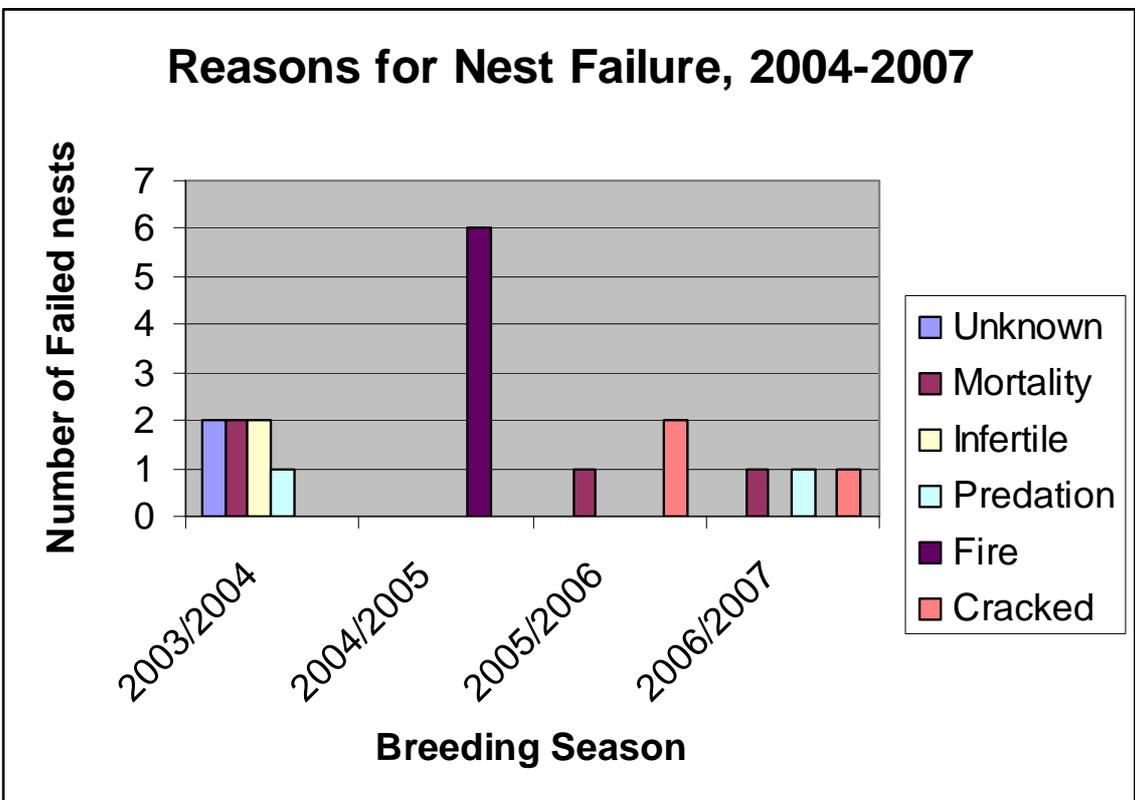
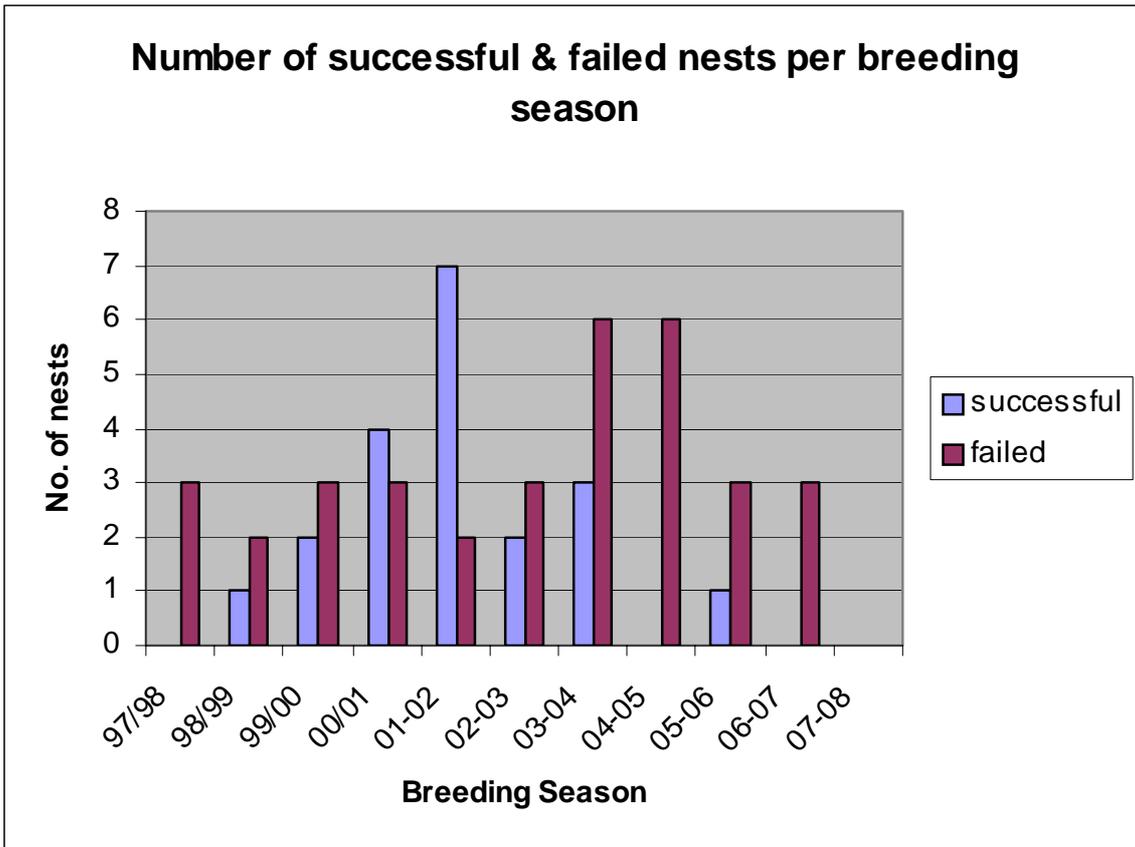


Figure 20 Causes of nest failure in Eyre Peninsula Yellow-tailed Black-Cockatoos

Monitoring involves weighing and measuring (culmen, right wing and tail) the chick approximately every 10-12 days between hatching and fledging. It also provides information on general development and health (e.g. crop fullness and feather development), including an opportunity to check for and treat problems such as flea, tick and black ant infestations.

Chick growth curves (weight change over time and weight versus wing length) are shown in Appendix B.

Each chick is fitted with individual leg bands for identification during the last monitoring visit just prior to fledging (Table 4). Band re-sight data are discussed in Section 3.4.

Table 4 Leg band data for Eyre Peninsula Yellow-tailed Black-Cockatoo chicks, 1998-2008.

BREEDING SEASON	LEFT LEG	RIGHT LEG	Nest Name	Notes
1998/1999	Blue 801	none	n/a	
1999/2000	Green	Silver 929	n/a	
	Green	Silver 933	n/a	
2000/2001	Blue 25	Silver 935	S-bend	
	Blue 29	Silver 931	Cowbones	
	Blue 28	Silver 930	Bald Hill Road	
2001/2002	Yellow 828	Silver 044	Bald Hill Road	
	Yellow 835	Silver 049	Woodpile	
	Purple 834	Yellow 045	Knobbles	
	Silver 934	Yellow 039	Pink Eye	
	Purple 833	Silver 050	Cowbones	
	Silver 932	Yellow 043	Black Stump	
2002/2003				Data unavailable
2003/2004	Silver 309 (210-10989)	None	Burnt Tree	
	Silver 314 (210-10999)	None	Dam Poly	Chick died before fledgling, band collected.
	Silver 315 (210-11051)	None	Dump	
	Silver 316 (210-11052)	None	Deep	
2004/2005				2005 Wangary fire. No recruitment.
2005/2006	None	Silver AZB 089	Egypt	Still present in current flock
2006/2007				One chick. Died just before fledging
2007/2008				No breeding detected.

3.3 Egg salvaging program

Low recruitment levels of the Eyre Peninsula Yellow-tailed Black-Cockatoo prompted the Recovery Team to begin salvaging any fertile second-laid egg as a priority recovery action in 1998. The Eyre Peninsula Yellow-tailed Black-Cockatoo often lays two fertile eggs, but generally raise only one chick successfully; usually from the first egg laid. By salvaging second-laid eggs, it was the Recovery Team's intention to:

1. Conserve individuals in a secure environment that would have otherwise been lost from the wild population.
2. Establish a captive breeding population to provide captive-bred Eyre Peninsula birds for reintroduction.

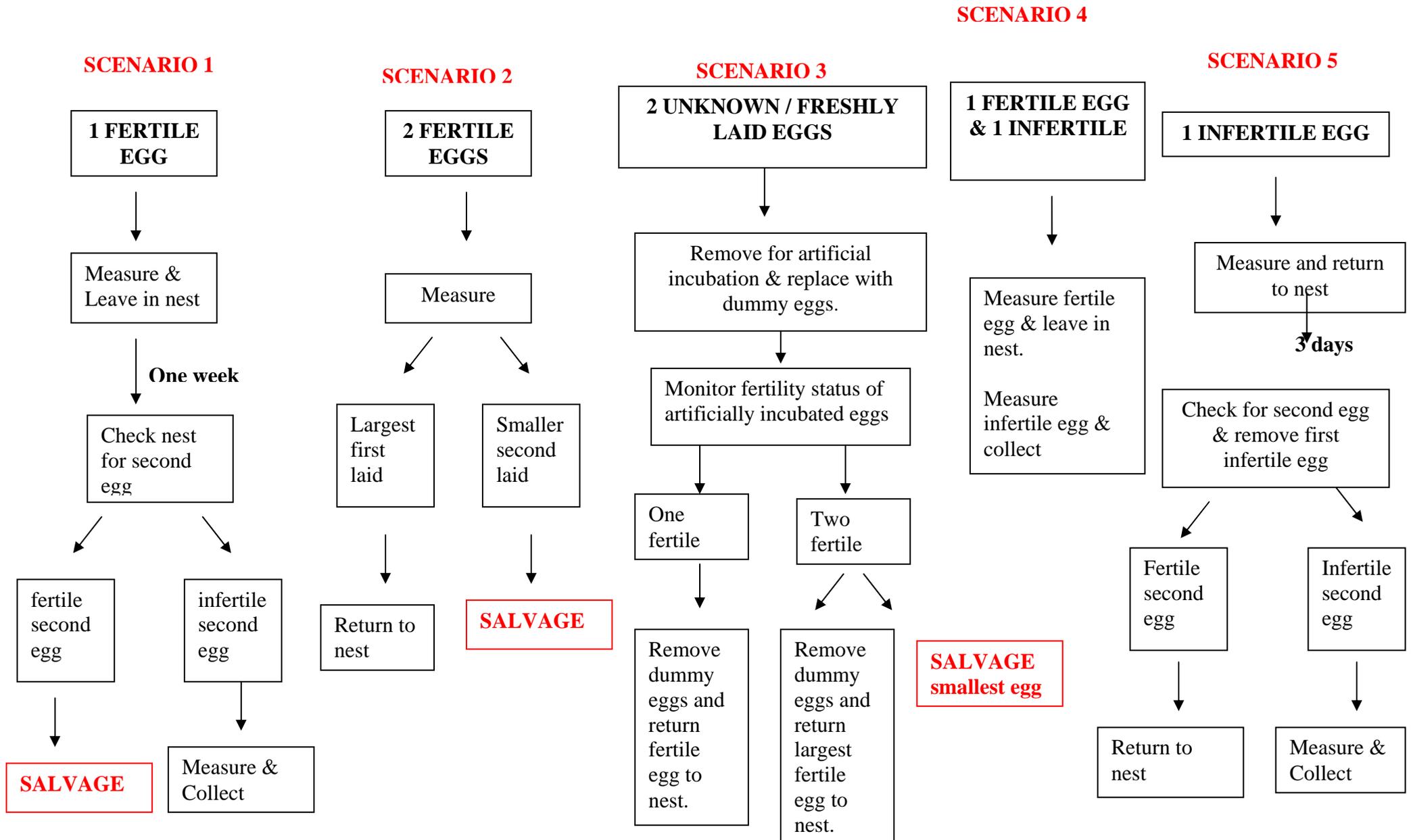
The Gorge Wildlife Park has been involved from the first captive-rearing trials in 1998 (See Section 4.1).

Since 1998 at least 11 second-laid eggs and three weak chicks have been salvaged from Eyre Peninsula Yellow-tailed Black-Cockatoo nests and transported to the Gorge Wildlife Park for incubation and/or hand-rearing. Eggs are transported under an incubation host (a broody domestic hen sourced locally) in a pet pack via aeroplane from Port Lincoln to Adelaide. Salvage methodology is outlined in Figure 21.

Two of the salvaged chicks were second-hatched chicks and one chick had a damaged wing. Only one of the three salvaged chicks survived: the one with the damaged wing (Female).

Eleven birds have been successfully raised in captivity from salvaged eggs. One sickly fledgling died in May 2008 after late weaning and failing to maintain body condition despite feeding well. (Section 4.1)

Figure 21 Egg salvaging program methodology



3.4 Population monitoring and census

3.4.1 Monitoring and census

Census of the Eyre Peninsula Yellow-tailed Black-Cockatoo population is attempted biannually: during the breeding season when the birds first return to their southern range and in their northern range during the winter. During population monitoring, the following data are collected:

1. Maximum number
2. Sex ratio
3. Re-sights of bands
4. Identifiable pairs
5. Proportion of juveniles and breeding/non breeding birds

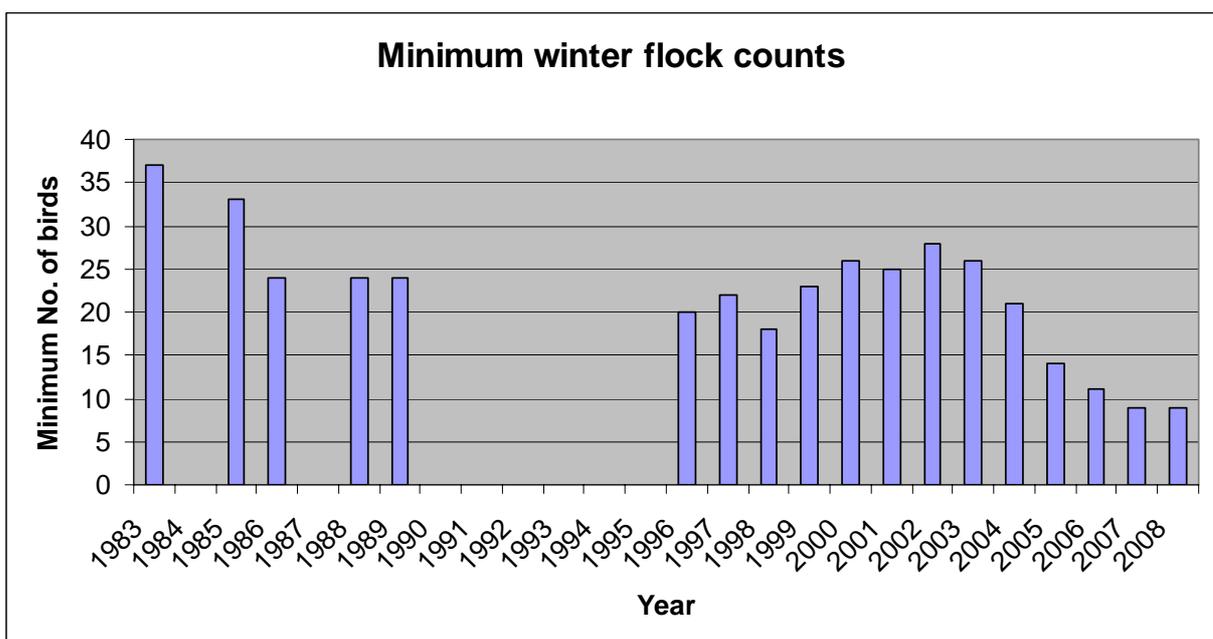
The project officer relies heavily upon community volunteers for much of this data. *Cocky Diaries* are distributed in both the northern and southern areas and provide a calendar month per page for recording observations. Cocky Diary data allows cross referencing of observations, which provides a more accurate estimation of minimum flock sizes. Band re-sight data also helps with this verification, with some banded birds turning up in the winter flock, but not observed with the breeding population in the breeding area.

Identifying the flock as soon as possible on its return to the breeding area provides the most accurate estimate of numbers, as breeding and non-breeding birds have not yet begun to separate. Since 2004, it has become increasingly difficult to locate non-breeding birds during the summer. Considering recent declines (Figure 22), this may in fact be because there are very low numbers (excluding dependant juveniles), if any, of this demographic in the population.

The winter census is of particular importance, as it allows confirmation of fledgling survival and provides the best opportunity to observe breeding and non-breeding birds.

Population monitoring also provides important information of habitat use and movements (Figure 2) Observations from the community have identified 1-3 individuals that have remained south for the winter since 2005. Similarly, unconfirmed sightings of a flock of seven birds in the winters of 2004 and 2005 north east of Ceduna may potentially indicate a northern range extension for the population.

Figure 22 Eyre Peninsula Yellow-tailed Black-Cockatoo minimum winter flock observations, 1983 - current¹.



¹ Data lacking for 1984, 1987, 1990-1996.

3.4.2 Band Re-sights

Successful band re-sights have unfortunately been infrequent and difficult to obtain. Thirty-seven observations of 16 banded birds have been recorded since banding began in 1998. Of these 37 observations, 17 led to a positive identification (46%). Positive identification records of banded birds are shown in Table 5.

Table 5 Re-sights of banded birds.

AD = adult

ADM = adult male

ADF = adult female

JUV = juvenile

SIGHTING DATE	LEFT LEG	RIGHT LEG	SEASON BANDED	ORIGINAL NEST	AD/JUV
22-Nov-2000	GREEN	SILVER933	1999/2000	UNK	JUV
22-Nov-2000	GREEN	SILVER929	1999/2000	UNK	JUV
22-Nov-2000	GREEN	SILVER933	1999/2000	UNK	JUV
20-Aug-2004	SILVER315	NONE	2003/2004	DUMP	JUV
20-Aug-2004	SILVER316	NONE	2003/2004	DEEP	JUV
2-Jun-2005	SILVER932	YELLOW	2001/2002	BLACKSTUMP	ADF
2-Jun-2005	BLUE	SILVER	2000/2001	UNK	ADM
2-Jun-2005	SILVER316	NONE	2003/2004	DEEP	JUV
1-Jan-2006	BLUE	SILVER	2000/2001	UNK	ADM
9-Jan-2006	SILVER	YELLOW	2001/2002	BLACKSTUMP or PINKEYE	AD
31-May-2006	BLUE	SILVER	2000/2001	UNK	ADM
31-May-2006	SILVER932	YELLOW	2001/2002	BLACKSTUMP	ADF
1-Aug-2006	SILVER932	YELLOW	2001/2002	BLACKSTUMP	ADF
1-Aug-2006	NONE	SILVER_AZB089	2005/2006	EGYPT	JUV
1-Aug-2006	BLUE	SILVER	2000/2001	UNK	ADM
20-Oct-2006	SILVER932	YELLOW	2001/2002	BLACKSTUMP	ADF
30-Jan-2008	BLUE	SILVER	2000/2001	UNK	ADM
30-Jan-2008	NONE	SILVER_AZB089	2005/2006	EGYPT	AD

3.5 Genetic Research

Since the project began, feather samples have been opportunistically collected from all monitored chicks and opportunistically from the field. Initial genetic analysis from this material proved inconclusive and exposed potentially convoluted relationships between subspecies *funereus* and *xanthanotus* throughout Australia (Section 1.1.2, van Weenen and Cooper 2000). It was clear that more extensive sampling was needed for further clarification.

Since 2006, over 120 Yellow-tailed Black-Cockatoo feathers have been collected across South Australia from populations in the south-east, Kangaroo Island, Eyre Peninsula and Mount Lofty Ranges. Feathers were also sampled from the 12 captive birds at the Gorge Wildlife Park. Museum Victoria is currently assessing the genetic diversity and degrees of relatedness of South Australia's Yellow-tailed Black-Cockatoo populations using microsatellite markers developed for psittacine birds (including parrots, lorikeets and macaws).

The aims of the research include:

1. Assess levels of genetic diversity within each of the South Australian populations of Yellow-tailed Black-Cockatoos (Eyre Peninsula, Mt Lofty Ranges, South-east SA and Kangaroo Island).
2. Assess the degree of connectivity and relatedness between each of the Yellow-tailed Black-Cockatoo populations in South Australia
3. Assess the genetic makeup and degree of relatedness of individuals in the captive population of Eyre Peninsula Yellow-tailed Black-Cockatoos.

To date, the analysis of relatedness (R) of the captive colony has been completed (Aim 3) and results are shown in Table 6. The results from the captive population suggest that the Eyre Peninsula birds are not significantly inbred and the level of genetic variability represented by this small sample size is relatively diverse. A comparison of the captive population's genetic variation with that from a group of eight Yellow-tailed Black-Cockatoos sourced from Victoria further confirmed that the captive group is not grossly devoid of genetic variation.

Preliminary results (August 2008) from analysis of microsatellite data to investigate Aims 1 and 2 have indicated significant differences in genetic structure between Eyre Peninsula and other South Australian populations of Yellow-tailed Black-Cockatoos. At this stage, the reasons for this difference is unclear, but may be explained by a number of processes:

- Consequences of small population size (inbreeding creating a novel distribution of allele frequencies)
- Geographic isolation of the Eyre Peninsula population
- Introgressions of east coast (*funereus*) genes

Analysis has also shown that the Eyre Peninsula population lacks novel variant alleles required to support subspecies status. For example, Victorian, New South Wales and Queensland populations possess novel allele variants not found in South Australian populations supporting the separation of *whitei* and *funereus*. (J. Norman, Museum Victoria, pers.comm.)

Table 6 Estimated relatedness (*R*) amongst birds from Gorge Wildlife Park captive breeding population (n=16).

To simplify interpretation negative *R* values have been replaced by 0. GWP birds are indicated by their band number; sex (m=male, f=female). Sample 16 is an unpaired female from Mt Lofty Ranges. Birds showing high levels of genetic relatedness (≥ 0.5) are indicated in bold. Relatedness for currently paired (as of April 2008) breeding birds are shaded.

Bird ID	Sex	1 M	2 F	3 F	4 M	5 F	6 JUV	7 M	8 M	9 F	10 M	11 F	12 ¹ JUV	13 JUV	14 M	15 F
1 0001BE95CA	M	*														
2 0001C5584F	F	0.44	*													
3 0001CDE234	F	0	0	*												
4 0001E7506D	M	0	0	0.34	*											
5 000600A0FF	F	0.55	0.87	0	0	*										
6 00064CD7EC	JUV	0	0	0	0.06	0	*									
7 00066D5241	M	0	0	0.36	0.59	0	0	*								
8 000600E8EE	M	0.31	0.75	0	0	0.92	0	0	*							
9 000600D216	F	0	0	0.08	0.21	0	0	0.15	0.13	*						
10 east coast M	M	0	0.06	0	0	0	0	0.09	0.08	0	*					
11 east coast F	F	0.13	0.69	0	0.07	0.87	0	0	0.86	0.29	0	*				
12 000682C8FA	JUV	0	0	0.16	0.28	0	0.43	0.11	0	0.52	0	0.03	*			
13 000689CDD0	JUV	0	0.22	0.29	0.60	0	0.06	0.43	0.12	0.47	0	0.31	0.68	*		
14 Male KI	M	0	0	0.66	0.43	0	0.05	0.49	0	0.24	0	0	0.19	0.13	*	
15 Female EP ²	F	0	0	0.17	0.49	0	0.61	0	0	0.23	0	0.12	0.59	0.55	0.24	*
16 4105441F48	UNK	0.63	0.59	0	0	0.39	0	0	0.31	0	0	0.17	0	0	0	0

¹ Juvenile 000682C8FA died in May 2008

² Presumed Broken-Wing Female, no microchip

3.6 Supplementary feeding trials

The combination of effects from the 2005 fire and the 2005/2006 drought year had a significant impact on the food resources available for breeding Eyre Peninsula Yellow-tailed Black-Cockatoos. The 2006/2007 season was considered the worst in terms of food availability and food resources were at a critically low level. It was estimated that 69% of Aleppo Pine trees were lost in the breeding area after the 2005 fire. Some Aleppo Pine feed trees in the breeding area that survived the 2005 Wangary fire have died since the 2005-06 season. There was poor cone development in remaining Aleppo Pine trees in response to drought conditions as well as a significant lack of *Xanthorrhoea* flower spikes reducing the availability of *Meyriccia latro* larvae. Native food resources (both naturally occurring and those planted as part of revegetation efforts) were immature and cones of *Hakea* spp. had yet to develop on regenerating plants.

In anticipation of this situation and as part of the Lower Eyre Peninsula Bushfire Reestablishment Program, Nature Foundation SA funded an investigation into the feasibility of supplementary feeding Eyre Peninsula Yellow-tailed Black-Cockatoos (Bellchambers 2006). The report states that the risk of losing the population of Eyre Peninsula Yellow-tailed Black-Cockatoos is so high that to proceed with supplementary feeding may seem to outweigh the risk of taking no action or doing the wrong thing.

In December 2006 the Recovery Team decided to proceed with supplementary feeding trials using Aleppo Pine cones as the supplementary food resource.

960 Aleppo Pine cones (480 cone-foliage and 480 cone-only) were offered at a total of four sites over three weeks in February 2007. Cones were supplied on the ground under an active Aleppo Pine feed tree at two sites and in trays attached to lower branches of an active Aleppo Pine feed tree at two sites

Only three supplementary cones (0.31%) were identified as being chewed by an Eyre Peninsula Yellow-tailed Black-Cockatoo. Two were from ground sites, one from a feeding tray.

The percentage of cockatoo-chewed cones may have been larger. 57 cones (5.9%, 6 cone-foliage and 50 cones only) were recorded as missing and Eyre Peninsula Yellow-tailed Black-Cockatoo chewing could not be confirmed for these cones.

Some key findings to increase utilisation of supplemented food if trials are repeated in the future include:

1. Use green cones cut with a sprig of foliage.
2. Provide cones that are harvested the same day they are supplied at supplementary feeding sites.
3. Replace with fresh cones every 7-10 days, depending on average temperature. As a guide, cones should be replaced sooner (maximum 7 days) in consistent temperatures above 30°C.
4. Time the supply to correspond with when green cones within the canopy of the Aleppo Pine feed tree are exhausted, which may increase utilisation of supplied cones.

Full details can be found in Way (2007).

3.7 Habitat re-establishment and revegetation

3.7.1 Estimate of foraging requirements and implications for revegetation

Field observations have shown that EPYTBCs can strip the seeds from an average of eight Aleppo pine cones in one hour (J. Cooper, pers. comm.). EPYTBCs usually have several foraging bouts in a day, each lasting between 1-2 hours: early-mid morning, and a couple in the afternoon (S. Way, pers. obs.). This is comparable to research conducted on foraging behaviour and energetics on Kangaroo Island's Glossy-Black Cockatoo population, where the average time spent foraging in a day by breeding males and females was 6.24 +/- 0.27 and 6.59 +/- 0.49 hours respectively (Chapman and Paton 2005). Along with the Aleppo Pine quantitative information presented in

Section 1.6.2, these data can be extrapolated to crudely¹ approximate the number hakeas required by each bird per year:

Mean no Aleppo pine seeds/cone=255
 Mean no seeds/ >1m height class of *Hakea rugosa* = 719

Therefore:

BREEDING MALE

8cones x 255 seeds x 6.24hrs/day x 365 days/year = 4,646,304 Aleppo Pine seeds/year
 4,646,304/719
 = 6,462 Hakea bushes equivalent/year

BREEDING FEMALE

8 cones x 255 seeds x 6.59hrs/day x 365 days/year = 4,906,914 Aleppo pines seeds/year
 4,906,914/719
 = 6,825 Hakea bushes equivalent/year

In total, 29055 tubestock has been planted since the beginning of the project (Table 7). The majority of the tubestock was *Hakea* spp, however not all plants have survived. Based on this number of tubestock, extra food has been provided (additional to what is already naturally occurring in the breeding area) for 4.5 breeding males (29,055/6,462) or 4.3 breeding females (29,055/6,825) since 1998.

3.7.2 Summary of revegetation to date

Revegetation efforts within the breeding area have been ongoing since 1998. The aims of the revegetation program are to:

1. Replace specific native food resources in the breeding area (E.g. Wrinkled Hakea, Elm-seed Hakea and Yaccas (Section1.6)
2. Re-establish Sugar Gum Woodland habitat and linkages across the landscape.

Wrinkled Hakea (*Hakea rugosa*) has been the predominate species propagated and planted, although Elm-seed hakea (*H. cycloptera*) and Yacca (*Xanthorrhoea semiplana*) have also been planted. Since 1998, over 25,000 tube stock have been propagated and planted in the breeding area (Table 7). Assessments of revegetation sites conducted in May 2008 identified the primary reason of failure to be low annual rainfall and drought conditions, herbivore grazing (kangaroos and/or European rabbit) and plant disease.

Table 7 Tube stock revegetation efforts in the breeding area, 1998-current.

Year	Approx. No. native food plants ¹ planted	No Sites	No properties	No Sites checked 2008	No. successful	No Failed
1998-2004	17,600	>16	>7	n/a	n/a	n/a
2005	3,600	13	4	8	8	0
2006	3,150	14	5	9	4	5
2007	1,305	4	4	4	3	1
2008	3,400	13	9	N/A	N/A	N/A

¹ Native food plants include *Hakea rugosa*, *H. cycloptera* and *Xanthorrhoea semiplana*.

Such quantities and ongoing propagation of native food resources are required to increase food availability in the breeding area. It is a time and labour intensive task that has only been achieved

¹ Data extrapolated for breeding birds only and assumes all birds forage at a rate of 8 Aleppo Pine cones/hour, forage for an average of 6.24(Males) and 6.59hrs (females) per day, eat exclusively seeds and that the amount of Aleppo Pine seeds needing to be consumed for baseline daily nutritional requirements is comparable to that of hakea seeds.

with the assistance of Greening Australia, school groups, local Green Corps teams, Friends of Parks and other project volunteers.

All of this revegetation has occurred on private land, requiring the permission of the individual landholder. The need for landholder agreement can sometimes restrict access to priority sites near known nesting remnants suitable for revegetation. Working within these constraints, site selection is prioritised based on proximity to known nesting remnants and existing feeding sites (both native and Aleppo Pines) as well as position in the landscape (i.e. ensuring adequate connecting habitat and avoiding isolated sites where possible).

As well as creating concentrations of foraging resources by hand planting propagated tube stock, direct seeding is used to improve connectivity throughout the breeding area. Direct seeding projects have had mixed success (Table 8). Fire, drought, inappropriate grazing practices and flood damage over the course of the project have caused germination failure at some sites.

Table 8 Direct seeding completed in the breeding area, 1998-current

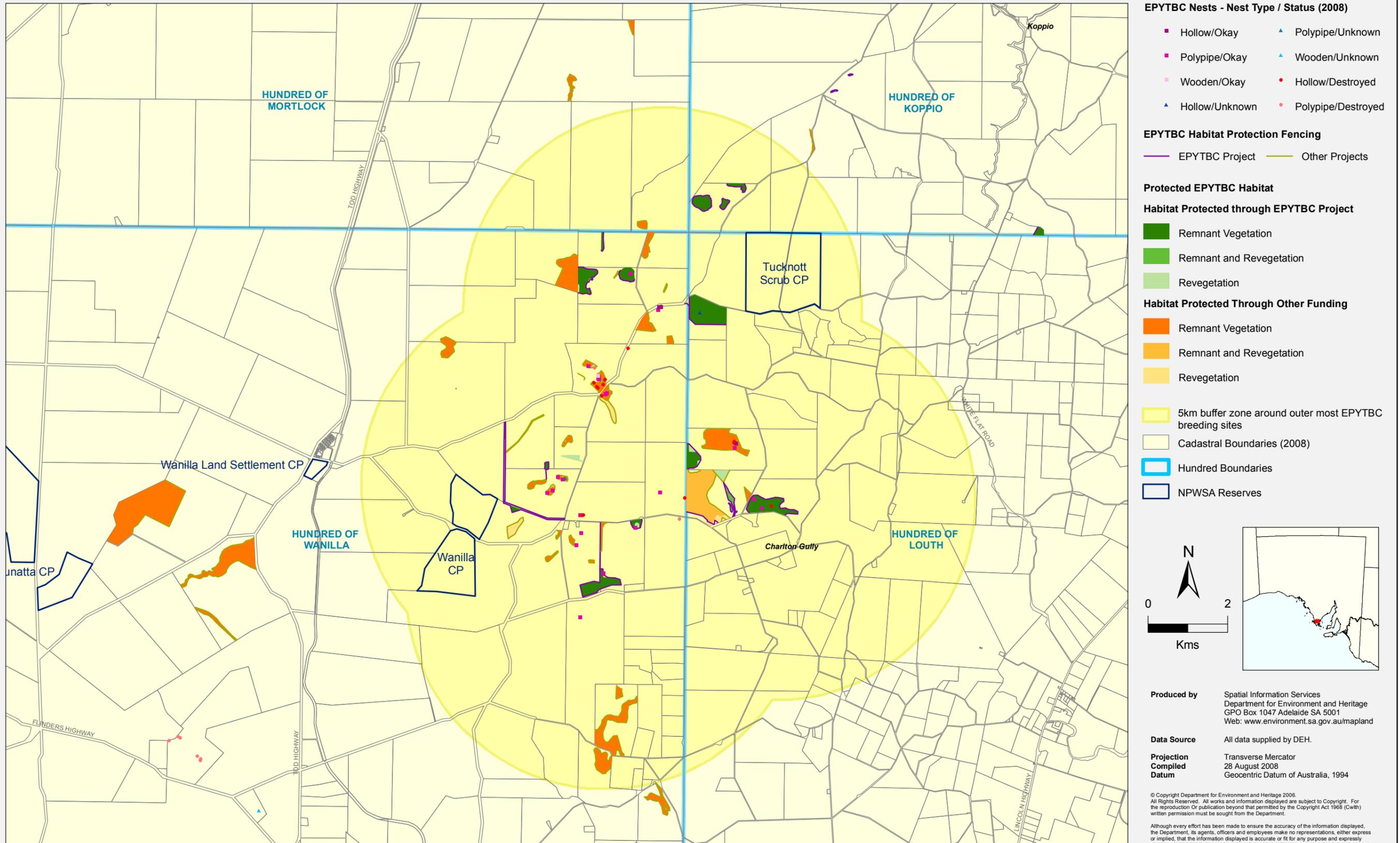
Year	Approx. No. kms seeded	OUTCOME
	2.5	Successful
1998-2003	6	Partly successful
	4.5	Failed. (Packer/Hyde)
2004	12.5	Failed (redone in 2007, see below)
2005	None	
	Recovery from 2005 fire	
2006	7 ¹	Unknown at time of writing
2007	9.5 ¹	Unknown at time of writing

¹ Funded as part of the Lower Eyre Peninsula Bushfire Re-establishment Program (Peeters and Way 2005)

Seventeen photo points have been installed to monitor a sample of revegetation sites across the breeding area. Some of these photo points were originally associated with the "Landcare project Sugar Gum Woodland Regeneration in the Todd/Wanilla basin" and were adopted by the Eyre Peninsula Yellow-tailed Black-Cockatoo recovery project. Photo point details are given in Appendix C.

No protective fencing, revegetation or direct seeding has been carried out in the northern habitat range. All project onground works (i.e. protective fencing, revegetation and direct seeding) sites as well as relevant works carried out by other projects (e.g. Community Streamcare and Landcare groups, Eyre Peninsula Natural Resources Management Board staff projects) are shown in Figure 23 and discussed further in Section 3.8.

Figure 23 Onground work (fencing, direct seeding and revegetation) sites within the Eyre Peninsula Yellow-tailed Black-Cockatoo breeding area.



3.8 Habitat protection

Protection of cockatoo habitat on private land is achieved through several processes. The main method is through providing landholders with fencing incentives in association with a voluntary Land Management Agreement from the Eyre Peninsula Natural Resources Management Board.

Flexibility is often needed and a lower incentive rates may be offered if the landholder does not want to sign an agreement. The Heritage Agreement process is also used to protect habitat. Approximately 43 Heritage Agreements occur within the southern range and approximately 34 in the northern range.

Habitat protection is also initiated and conducted independently by several key community groups in the region (e.g. Coomunga and Little Swamp Landcare Group and Charlton Gully Streamcare Group). In addition to these works by community groups, many landholders have independently protected habitat remnants on their properties (L. Bebbington, Habitat and Land Management Consultant, *pers. comm.*)

Since the project began, approximately 822 Ha has been protected and/or revegetated. The breakdown of this total area is as follows:

1. 90 Ha of protected remnant Sugar gum Woodland that has also benefited from revegetation.
2. 54 Ha of cleared area revegetated and protected.
3. 677 Ha of protected Sugar gum woodland remnant.

This is a minimum estimate of the total amount of onground works conducted and habitat protected in the region, as community groups and independent individuals have also significantly contributed (Figure 23).

3.9 Reintroduction trials

In 1998/99 breeding season, four eggs were collected from nests and hand reared at the Gorge Wildlife Park. (Section 3.3) The Port Lincoln Aboriginal Community Council assisted with installing a flight aviary at Wanilla Forest in the cockatoos' breeding area.

Once weaned, the juveniles were moved into the Wanilla Forest aviary to facilitate introduction to the wild flock. The Southern Eyre Avicultural society and local community members (Southern Eyre Birds Group Inc) helped with the feeding.

At nearly twelve months of age, three of the four juvenile birds were released to join up with the wild flock. Unfortunately, a fox took one of the released birds whilst another disappeared and was not relocated. The third bird was observed interacting with individuals of the wild non-breeding flock but was recaptured due to its lack of predator recognition and avoidance behaviour and was highly habituated to humans. This bird was retained for captive breeding at the Gorge Wildlife Park. The trial release program, whilst appearing unsuccessful, revealed key areas for improvement that will now increase the likely success of any future release attempt, namely:

1. Increasing the age of released birds.
2. Minimising human contact and habituation during captive feeding.
3. Ensuring captive birds obtain a satisfactory level of flight fitness before release
4. Investigating ways to teach predator recognition and avoidance behaviour.

4 EXISTING *EX SITU* CONSERVATION MEASURES

4.1 Hand-rearing

Gorge Wildlife Park staff are leaders in hand-rearing Australian Black-Cockatoo species, and have extensive experience with the various stages and requirements of incubation, assessing egg age and fertility as well as hand-rearing and weaning procedures. The Gorge Wildlife Park has provided vital voluntary assistance to the egg salvaging program.

Salvaged eggs are artificially incubated and monitored in an incubation room. Once hatched, chicks are hand-reared and are fed Paswell bird food and a mix prepared by the Gorge Wildlife Park via syringe 2-5 times a day until weaning at approximately 8 months of age.

Weaned chicks are microchipped and/or banded and a feather sample taken for genetic profiling before being transferred to outside aviaries. This information is entered into a studbook that was recently developed for the captive population in association with Adelaide Zoo (Carney 2007).

4.2 Captive colony

4.2.1 Population

There are currently (August 2008) 12 Eyre Peninsula Yellow-tailed Black-Cockatoos housed in five special breeding aviaries at the Gorge Wildlife Park: 11 individuals hatched from salvaged eggs and one captive bred juvenile (See Section 4.2.2). Of the salvaged individuals there are five hens, four cocks and two juveniles (Table 9). All but one bird (broken wing female) are micro-chipped for identification and originated from salvaged second-laid eggs from wild pairs on Eyre Peninsula (Section 3.3).

The aim of the captive colony is to provide captive-bred Eyre Peninsula Yellow-tailed Black-Cockatoos for a future population supplementation program.

Table 9 Details of captive Eyre Peninsula Yellow-tailed Black-Cockatoo population, Gorge Wildlife Park.

AVIARY	SEX	MICROCHIP ID	SEASON SALVAGED
2	Hen	00 0600 D216	2003
	Cock	00 0600 E8EE	2003
3	Hen	00 01C5 584F	2003
	Cock	00 01BE 95CA	2003
4	Hen	None (ID by broken right wing)	1996/1997
	Cock	00 01E7 506D	1998/199
5	Hen	00 0600 A0FF	1998/1999
		00 0670 15FA	2004/2005
		00 0689 CDD0	2005/2006
6	Hen	00 01CD E234 (also with leg band)	1998/1999
	Cock	00 066D 5241	2004/2005

4.2.2 Breeding

Four pairs have formed from the nine sexually mature birds. In the absence of genetic relatedness data, Gorge Wildlife staff encouraged pair bonds by housing together those birds already exhibiting bonding behaviour. It is the intension of the Recovery Team, in collaboration with Gorge Wildlife Park staff, to attempt future pair bonding that maximises genetic diversity based on analysis of genetic inter-relatedness within the captive colony (Section 3.5).

Breeding was first observed in December 2005 when Hen 00 0600 D216 and Cock 00 0600 E8EE laid infertile eggs on the ground.

In January 2007, the first captive-bred chick hatched at the Gorge Wildlife Park, but died at three weeks of age after it failed to gain weight. In 2007/2008 breeding season, the second captive-bred chick survived to fledgling, despite initial health concerns.

Breeding effort and success is shown in Table 10.

Table 10 Breeding attempts by captive Eyre Peninsula Yellow-tailed Black-Cockatoo breeding pairs, Gorge Wildlife Park.

Pair	Breeding Season	Egg details	Notes
Aviary 2 Hen D216 Cock E8EE	2005-2006	1 fertile	Laid from perch & cracked on ground
	2006-2007	1 fertile	Laid from perch but only slightly cracked. Artificially incubated by Gorge Wildlife staff & hatched but chick died at three weeks of age.
	2007-2008	1 fertile 1 infertile	Laid in hollow log nest. Chick hatched 1 st Feb 2008. Chick fledged 5 May 2008. Medical complications include fractured right ulna, fractured left ulna and radius, bowed femur, anaemia, Ca and protein deficiencies, infection.
Aviary 3 Hen 584F Cock 506D	2006-2007	1 infertile	Laid on floor. Cock 506D and Cock 95CA swapped aviaries in May 2007, as Hen 584F was bonding more with Cock 95CA.
Hen 584F Cock 95CA	2007-2008	3 clutches of 2 infertile eggs	All three clutches laid on floor of aviary.
Aviary 4: Hen (broken wing) Cock 506D	2006-2007	N/A	Utilised Poly-pipe nest box and incubated eggs, November 2006.
	2007-2008	2 infertile	Eggs laid in hollow log nest
Aviary 6: Hen E234 Cock 5241	2007-2008	2 clutches of 2 infertile eggs	Both clutches laid in poly pipe nest box. Hen sits very well.

5 RECOVERY STRATEGY, OBJECTIVES, AND ACTIONS

5.1 Recovery Priorities and Rationale

The overall long-term (20+ years) recovery objective is to:

1. Ensure the Eyre Peninsula Yellow-tailed Black-Cockatoo persists as a viable wild population by protecting and expanding the habitats which are critical for its survival;
and
2. Improve the conservation status of the Eyre Peninsula Yellow-tailed Black-Cockatoo by increasing the size and distribution of the Eyre Peninsula Yellow-tailed Black-Cockatoo population within its range.

To achieve this, the Plan aims to provide direction in addressing the following recovery priorities and rationale:

Halt the decline in & facilitate an increase in the wild population

1. Maximise the survival and recruitment of birds in wild.
Protection of nests
Protect and enhance existing habitat
2. Re-establishment of food resources and expansion of habitats.
3. Continue to manage & increase *ex situ* population.
 - Continuation of egg salvaging program
 - Develop a captive breeding program using the *ex situ* population.
4. Improve biological knowledge
5. Promote community and stakeholder awareness and participation in recovery.
6. Bolster the wild population through population supplementation with
 - captive-bred individuals (re-stocking), or
 - translocated individuals as appropriate.
7. Coordinate and Review Recovery Activities.

5.2 Specific Objectives and Actions.

Costings for recovery actions are listed in detail in Section 6.0 and Table 10. Budget allocations for each objective are given below as totals of funding sought (excluding project officer allocation and vehicle expenses) and in-kind contributions.

5.2.1 Objective 1: Maximise the survival and recruitment of birds in wild

FUNDING REQUIRED: \$36,505.00

INDICATION OF POTENTIAL IN-KIND CONTRIBUTION: \$6,738.40

NEST MONITORING

Action 1a: Continue to locate nests

Continue search effort for nest trees at the start of the breeding season during November and December. Conduct dusk and/or dawn watches from high points in the Koppio Hills overlooking known vegetation remnants where nesting has previously occurred..

Priority: Urgent

Time frame: Ongoing

Allocation: DEH, DEH contractor and volunteers.

Action 1b: Continue nest monitoring

Conduct nest monitoring every two weeks to monitor chick health and growth. However, in response to budget and/or personnel constraints, reduce nest checks to several visits throughout the season: first monitoring at initial location and assessment (breeding effort), second shortly after hatching (hatching success) and third for banding just prior to fledging (breeding success). If one egg is noted at first inspection, a second follow up visit is recommended within three days to check for second egg (refer to egg salvaging procedures in Action 3a, Section 5.2.3)

Remote cameras can be used to verify nest activity and condition without the need for qualified personnel to climb the tree. Depending on the height of the nest, a remote camera attached to an extendable pole can provide an image of the nest interior. Climbing may still be required to check fertility status if eggs are confirmed.

Priority: Urgent

Time frame: Ongoing

Allocation: DEH and DEH contractor, can be assisted by volunteers.

NEST PROTECTION

Action 1c: Continue nest protection.

Nest trees to be guarded with corrugated iron tree guards as soon as possible after first located to protect from possum predation. Tree guards are to be placed at least 0.5m above the base of the tree with corrugations running parallel to the trunk. The guard should be firmly fixed to the trunk with no gaps between meeting sheets. There should be enough room for the tree to grow, but not enough space for a possum to climb up between the guard and the tree. Pruning may also be required to isolate the canopy of adjacent trees. If this is not possible, adjacent trees may also need to be guarded.

Priority: Urgent

Time frame: Ongoing

Allocation: DEH and DEH contractor, can be assisted by volunteers..

Action 1d: Develop a mechanism to close poly pipe nest boxes for the winter to discourage nesting of non-target species (e.g. galahs and starlings).

Adjustments need to be made to existing poly pipe boxes already in the field (24). All new nest boxes should be made with removable doors before installation in the field.

Priority: Urgent

Time frame: Ongoing

Allocation: DEH and/or DEH contractor, can be assisted by volunteers.

Action 1e: Annual monitoring and maintenance of nest trees.

Nest trees should be checked annually prior to breeding season to:

1. Re-open poly pipe nest boxes (If Action 1d applied).
2. Check for, and destroy, European Honey-bee hives.
3. Maintenance of tree guards: loosening, repair.
4. Pruning of adjacent canopies if necessary.
5. Conduct any repairs to hollows and/or nest boxes.
6. Check for and destroy Galah breeding pairs.

Priority: High

Time frame: Ongoing

Allocation: DEH and/or DEH contractor

Action 1f: Humanely remove Galah (*Eolophus roseicapillus*) breeding pairs that have established in known Yellow-tailed Black-Cockatoo hollows and poly-pipe nest boxes and destroy their nests, eggs and chicks.

This action should only be pursued if Action 1e can be applied to ensure new Galah pairs do not move in and begin to utilise the vacant nesting site. Methods for destruction should comply with the South Australian Code of Practice for the Humane Destruction of Birds (DEH 2007a).

Priority: Urgent

Time frame: 2008/2009 to 2012/2013 breeding season.

Allocation: DEH or DEH contractor

PROTECT AND ENHANCE EXISTING HABITAT

Action 1g: Protect and manage selected Aleppo Pine stands on lower Eyre Peninsula.

Continue to liaise with the Eyre Peninsula Natural Resources Management Board (EPNRMB) Lower Eyre Pest Management Group to manage selected Aleppo pine trees identified as feeding habitat critical to survival, particularly in the breeding area, as identified in Figure 24 (from Way, 2006)

Priority: High

Timeframe: Ongoing.

Allocation: DEH and volunteers.

Action 1h: Strategic allocation of fencing incentives in the cockatoo breeding area.

Continue to work with EPNRMB staff to provide fencing incentives in the cockatoo breeding area.

Utilise fencing funds to:

1. Protect existing habitat remnants from grazing by domestic stock.
2. Identify opportunities to fence off paddock corners, fence lines or areas between remnants for future revegetation sites.
3. Widen existing linear corridors of native vegetation (i.e. windbreaks, property boundaries and roadside vegetation).
4. Within priority zones, focus on nodal areas where adjacent paddock corners, fencelines and/or properties can enable larger blocks to be established.

Fencing can be targeted to priority zones, as described below in Section 5.2.2, Action 2a.

Priority: High

Timeframe: Ongoing.

Allocation: DEH in collaboration with EPNRM staff.

Action 1i: Strategic direct seeding in the cockatoo breeding area.

Continue to work with EPNRMB staff to target direct seeding in those areas identified in Figure 25. Direct seeding mix should include a suite of Sugar Gum Woodland species. The desired outcome is to strengthen habitat linkages by re-establishing areas of Sugar Gum woodland rather than introducing specific food resource areas as in Actions 2a and 2b.

Priority: High

Timeframe: Ongoing.

Allocation: DEH in collaboration with EPNRMB and Greening Australia.

5.2.2 Objective 2: Re-establish food resources and expansion of habitats

FUNDING REQUIRED: \$7,329.00

INDICATION OF POTENTIAL IN-KIND CONTRIBUTION: \$3,625.00

INCREASE AVAILABILITY OF NATIVE FOOD RESOURCES IN SOUTHERN RANGE

Action 2a: Continue to create concentrated areas of native food resources through revegetation with *Hakea rugosa*, *H.cycloptera* and *Xanthorrhoea semiplana* tube stock at prioritised sites in the breeding area (Figure 25).

Aim to maintain a planting effort at least 3000 tube stock each season.

High, medium and low priority zones for habitat protection and revegetation have been identified down to a land parcel scale (GIS cadastral layer) within and adjacent to the core breeding area (Figure 25). A buffer extending 5km out from the core breeding area was established during Aleppo pine mapping in 2006 (Way 2006) (Figure 24) and is used to define the high priority zone.

High and medium priority sites were further identified in both the high and medium priority zones based on those land parcels containing remnant Sugar Gum Woodland or *Xanthorrhoea* mixed shrubland.

High priority zone: properties within the core breeding area.

High and medium sites (land parcels) within the high priority zone should be immediately targeted for revegetation and/or protective fencing. High priority sites also include protected and previous revegetated sites where the revegetation has failed (due to fire, kangaroo/rabbit grazing or drought) or where there is space for additional tubestock. Detailed information of associated

landholders and GPS locations of previous revegetation from 2005-2008 and revegetation assessment data is kept on file at DEH, and is not included here for privacy reasons (*200x Reveg Program_Project XXX.xls* and *Reveg Site Assessment 2005to2007.doc* respectively)

Medium priority zone: properties adjacent to the core breeding area < 5km from the edge of the high priority zone.

Low priority zone: remaining properties on the periphery of the breeding area buffer >5km away from known feeding and nesting habitat in the high priority zone. This zone should be targeted opportunistically if no high or medium sites can be accessed. The low priority zone may provide opportunities to create corridors along fence lines. The habitat value of the low priority zone will become increasingly important, providing additional habitat required to support an increasing cockatoo population.

Priority: Urgent

Timeframe: Ongoing.

Allocation: DEH in collaboration with EPNRMB, DEH contractor and volunteers

Action 2b: Trial direct seeding of *H. rugosa* and *H. cycloptera*.

Dependant on availability of locally indigenous seed stock, trial direct seeding of *Hakea* species at high or medium priority sites to create concentrated food resource areas. Direct seeding trials would also compare the success of the direct seeding technique to the time and labour intensive tube stock revegetation method.

Priority: High

Timeframe: Winter 2008 & 2009

Allocation: DEH Contractor.

Action 2c: Continue with established Aleppo pine supplementary feeding stations in the breeding area during 2007-2010 summers.

Follow recommendations in Way (2007), including:

- Harvest green Aleppo Pine cones with foliage sprigs.
- Provide cones the same day they are harvested.

Provide supplementary food at three established sites during future breeding seasons:

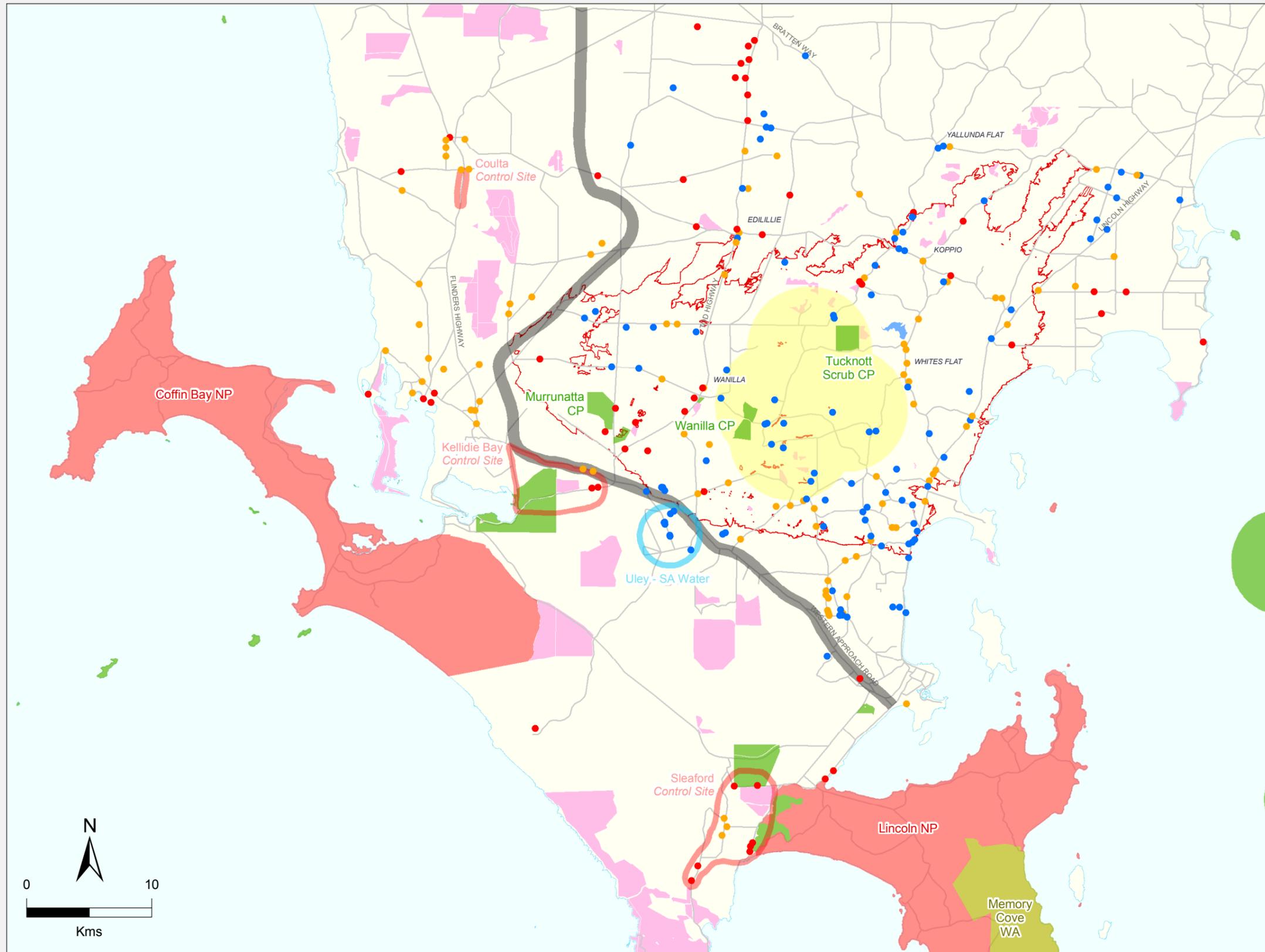
1. Holness Aleppo Pine - trays (GPS WGS84 53H 0568862, 6180705).
2. Dairy Pine - trays (GPS WGS84 53H 568659, 6176822).
3. Packer/Cooper drinking perch -trays (GPS WGS84 53H 568562, 6176793).

Priority: High

Time frame: 2008/2009 to 2010/2011 breeding season. Re-assess the need for breeding season supplementary feeding in the summer of 2010.

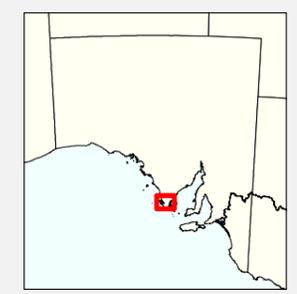
Allocation: DEH and/or DEH contractor, with assistance from volunteers

Figure 24 Aleppo Pine Control Boundary and Priority Sites, Lower Eyre Peninsula (from Way 2006)



- Aleppo Pine Sites**
- Control Priorities
- Control, High Priority
 - Control, Medium/Low Priority
 - Retain
- Aleppo Pine EPYTBC Feed Sites Recommended for Retention.
- Priority Aleppo Pine Control Sites to Benefit Biodiversity
- ▬ Boundary for Priority Aleppo Pine Control
- 5km buffer zone around outer most EPYTBC breeding sites
- NPWSA Reserves**
- Conservation Parks
 - Conservation Reserves
 - National Parks
 - Wilderness Protection Areas
- Fire Boundary January 2005
- Tod River Reservoir
- Roads
- Vegetation Heritage Agreements

N.B. For SA Water land, only those Aleppos known as EPYTBC feeding sites are shown and Aleppo pines have not been mapped in the Coultas priority area.



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Data Source All data supplied by DEH.

Projection Compiled Datum Transverse Mercator
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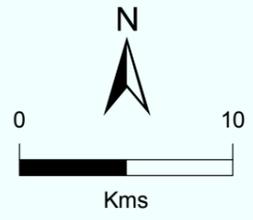
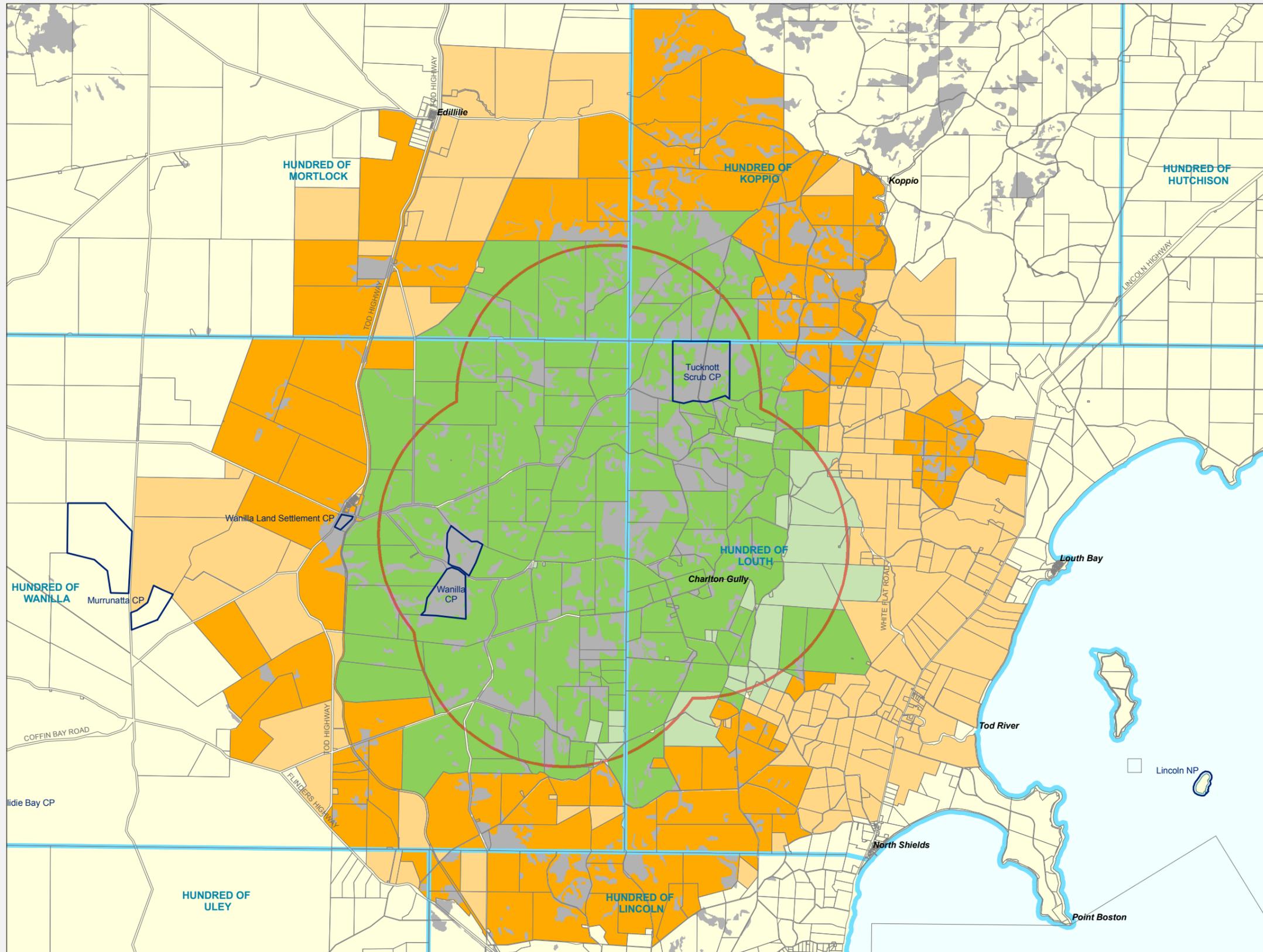
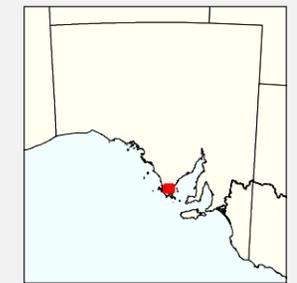
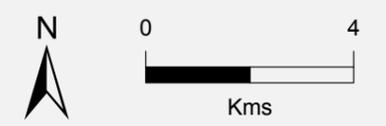


Figure 25 Priority zones for revegetation and habitat protection in the Eyre Peninsula Yellow-tailed Black Cockatoo core breeding area



- Appropriate Remnant Native Vegetation**
- Eucalyptus cladocalyx woodland or Xanthorrhoea semiplana ssp. (mixed) shrubland >1m
- Priority Revegetation and/or Habitat Protection Sites**
- Priority revegetation sites are parcels of land within priority revegetation zones that *contain* appropriate remnant native vegetation
- High Priority Sites
 - Medium Priority Sites
- Priority Revegetation and/or Habitat Protection Zones**
- The Priority Revegetation Zones contain parcels within 5kms and 10kms of the EPYTBC breeding sites
- High Priority Zone
 - Medium Priority Zone
- 5km buffer zone around outer most EPYTBC breeding sites
 - Cadastral Boundaries (2008)
 - Hundred Boundaries
 - NPWSA Reserves



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Data Source All data supplied by DEH.

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5.2.3 Objective 3: Continue to manage and increase ex situ population

N.B.: Actions for Objective 3 should only continue if population supplementation proposals are approved (Refer to Objective 6, Section 5.2.6)

FUNDING REQUIRED: \$135.00

INDICATION OF POTENTIAL IN-KIND CONTRIBUTION: \$23,505.00

CONTINUE EGG SALVAGING PROGRAM

Action 3a: Recover "surplus" eggs to *ex situ* population

During initial checks of new nests (see Action 1a, Section 5.2.1), apply the egg salvaging protocols depicted in Figure 21.

Priority: Urgent

Timeframe: Ongoing with annual assessment based on housing capabilities and capacity of Gorge Wildlife Park.

Allocation: DEH, DEH contractor & Gorge Wildlife Park.

Action 3b: Apply baseline captive rearing hygiene protocols in association with Gorge Wildlife Park.

Apply the following baseline hygiene protocols:

Incubation of salvaged eggs:

- One incubator to be kept exclusively for incubating Eyre Peninsula Yellow-tailed Black-cockatoo eggs.
- Incubator to be sterilised after egg has hatched.

Hand rearing of hatched chicks from salvaged eggs:

- Exclusive holding containers for Eyre Peninsula Yellow-tailed Black-Cockatoos.
- Holding containers sterilised after weaning.
- Feed allocated for Eyre Peninsula Yellow-tailed Black-Cockatoos to be stored separately from feed for other species.
- Exclusive feeding syringes for each Eyre Peninsula Yellow-tailed Black-Cockatoo chick.

Priority: High

Timeframe: December 2008.

Allocation: potentially Adelaide Zoo & Gorge Wildlife Park.

Action 3c: Record salvaged egg development data

The following data to be record for each egg salvaged:

- Salvage details collected by DEH and provided to the Gorge : date salvaged, nest name, nest location and original egg measurements (weight, length & width).
- Salvage details provided by Gorge Wildlife Park: hatch date, regular growth data (weight every week), weaning date, microchip number.

Data sheet to be provided to the Gorge Wildlife Park with each egg salvaged and a copy kept at the DEH office. Data for each chick to be sent to DEH for entry onto Egg Salvage Database after weaning.

Priority: High

Timeframe: Ongoing from 2007/2008 breeding season

Allocation: DEH & Gorge Wildlife Park.

DEVELOP A CAPTIVE BREEDING PROGRAM USING THE *EX SITU* POPULATION

Action 3d: Reassess current pairing of birds in response to results of genetic relatedness coefficients (R) from Museum Victoria (Table 6).

Separate the following pairs with high R values that are currently housed together and re-pair them with partners with lower R values:

Female 0001C5584F and Male 0001BE95CA (Aviary 3 as of June 2008)

Female Broken Wing and Male 0001E7506D (Aviary 4 as of June 2008)

Pairings could be facilitated by:

1. Cocks and hens with the lowest R values (i.e. least genetically similar) to be paired in the Gorge Wildlife Park aviaries.

2. Sexually mature cocks and hens with compatible R values housed together in a flight aviary at Monarto or Adelaide Zoo. Once pairs are naturally established, transfer pairs back to breeding aviaries at the Gorge Wildlife Park.

Priority: Urgent.

Timeframe: Before the start of the 2008/2009 breeding season in November 2008.

Allocation: Gorge Wildlife Park and Adelaide Zoo

Action 3e: Modify nest boxes to allow *in situ* monitoring of eggs.

Small doors to be fashioned into side wall of the nest box level with nest. This action will facilitate Action 4d.

Priority: Urgent.

Timeframe: Before the start of the 2008/2009 breeding season in November 2008.

Allocation: Gorge Wildlife Park.

Action 3f: Provide choice of nest boxes in breeding aviaries.

By providing a choice of nest boxes, breeding hens are more likely to successfully lay in their choice of nest. Where possible, three nest boxes are to be provided including natural hollows and poly-pipe nest boxes.

Priority: High

Timeframe: Before 2008/2009 breeding season.

Allocation: Gorge Wildlife Park and Adelaide Zoo.

Action 3g: Procedure established for monitoring captive-laid eggs.

Refer to monitoring procedures outlined in Figure 26. These procedures are dependant on Action 4b. Laying, hatching and fledging dates for each breeding pair to be recorded for entry into the Stud Book (Action 4e). Chicks to be fed naturally by parents but checked *in situ* once a week and weighed fortnightly to detect any health problems.

Priority: High

Timeframe: Before 2008/2009 breeding season.

Allocation: Gorge Wildlife Park and Adelaide Zoo.

Action 3h: Continue to maintain studbook of captive population.

The Gorge Wildlife Park and Adelaide Zoo developed a studbook for the captive breeding colony in July 2007. All breeding data to be incorporated into the studbook during each breeding season.

Priority: High

Timeframe: Ongoing.

Allocation: Gorge Wildlife Park in collaboration with Adelaide Zoo.

Action 3i: Procedure established for feeding captive-bred chicks pre-fledging.

The priority is for parent birds to feed the chick during incubation until fledging. The chick should only be removed from the nest for hand rearing if *in situ* monitoring (Action 4d) identifies a health problem. If hand rearing is required, procedures to minimise human habituation is paramount. (Refer to Action 6c, Section 5.2.6)

Priority: High

Timeframe: Before 2008/2009 breeding season.

Allocation: Gorge Wildlife Park and Adelaide Zoo.

Action 3j: Develop and apply baseline health checks for captive population

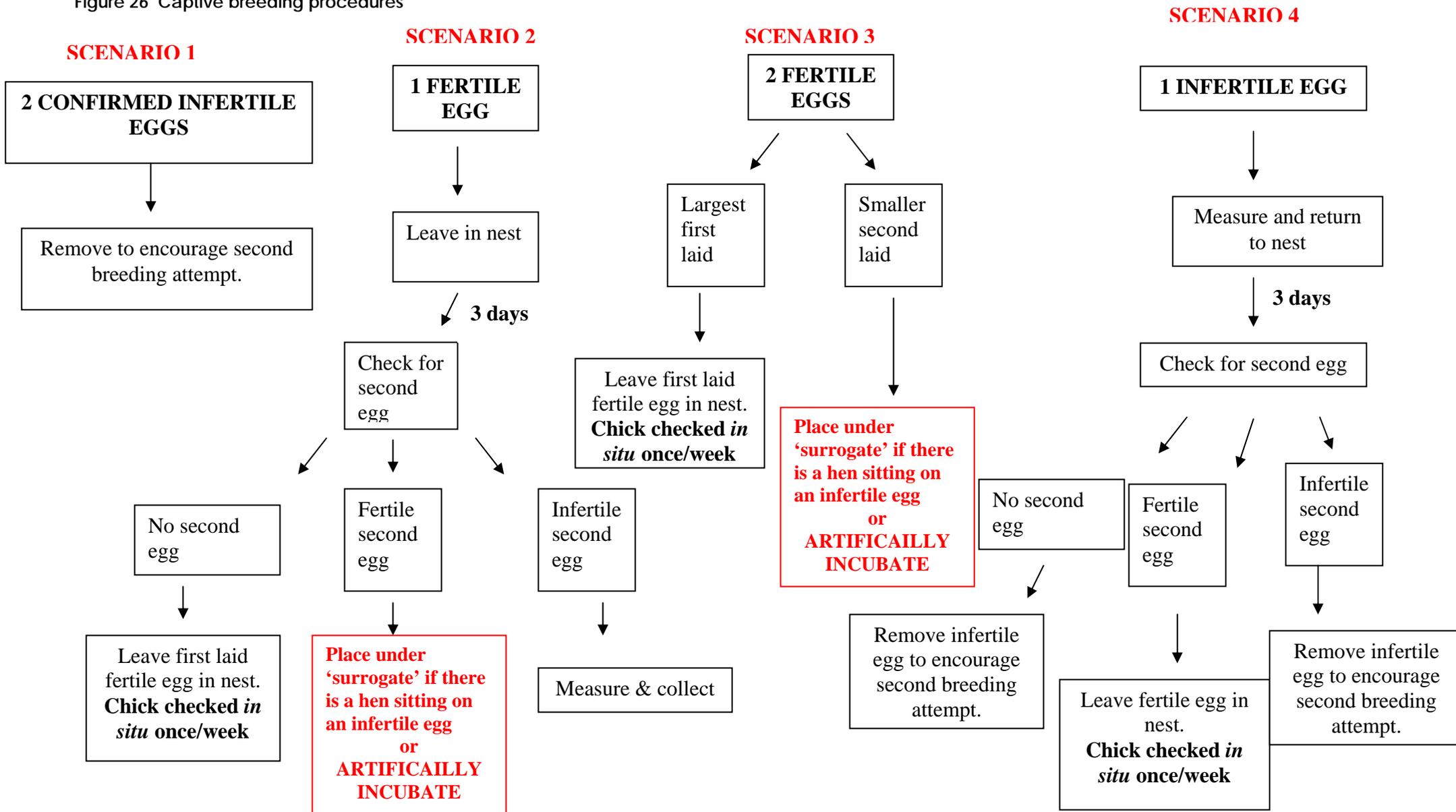
Regularly test captive individuals for standard health indicators (e.g. parasite loads), as advised by the Adelaide Zoo.

Priority: High

Timeframe: Ongoing.

Allocation: Adelaide Zoo and Gorge Wildlife Park

Figure 26 Captive breeding procedures



5.2.4 Objective 4: Increase biological knowledge

FUNDING REQUIRED: \$2,374.00

INDICATION OF POTENTIAL IN-KIND CONTRIBUTION:\$11,750.00

Action 4a: Confirm the degree of genetic variation and relatedness between and within South Australia's Yellow-tailed Black-Cockatoo populations.

Genetic analysis is being undertaken by Museum of Victoria at time of writing (Section 3.5). Genetic results will influence the most appropriate re-stocking options for the Eyre Peninsula population (i.e. re-stocking with captive breeding stock or translocation from other SA populations)

Priority: Urgent

Timeframe: December 2008

Allocation: Museum Victoria

Action 4b: Obtain genetic profiles and R values (Relatedness) of all future salvaged Eyre Peninsula Yellow-tailed Black-Cockatoo chicks.

Museum Victoria has determined the individual genetic profiles for the entire captive colony (Section 3.5). Genetic profiling of newly salvaged birds added to the captive population will further inform which birds to pair for breeding to maximise genetic diversity.

Priority: Urgent

Timeframe: Ongoing from 2007/2008 breeding season

Allocation: previously Museum Victoria and Gorge Wildlife Park.

Action 4c: Conduct nutritional analysis of diet fed to captive colony.

Analysis to include: mineral analysis, vitamin profiles, amino acid profiles, dry matter, crude protein, ADF, ME, Gross En, crude fat, ash and total starch. (See also Section 5.2.5, Action 5c)

Priority: Urgent

Timeframe: December 2008

Allocation: DEH and DEH contractor.

Action 4d: Autopsies to be carried out on all deceased individuals.

Gorge Wildlife Park to contact Adelaide Zoo veterinarians as soon as possible following any mortality to obtain a better understanding of cause of death of captive individuals. Bodies to be bagged and refrigerated (not frozen) until autopsy.

Priority:High

Timeframe: Ongoing

Allocation : Adelaide Zoo and Gorge Wildlife Park

Action 4e: Continue summer and winter population census.

Winter population census to be conducted shortly after the completion of the winter migration in May-June and summer census to be conducted on the birds' return to the breeding area in October-December. Data collection includes:

1. Total flock numbers
2. Gender ratios
3. Identification of banded and/or unbanded juveniles.
4. Identification of banded adult birds.

Priority: High

Timeframe: Ongoing, bi-annually in summer and winter.

Allocation: DEH and/or DEH Contractor

5.2.5 Objective 5: Promote community and stakeholder participation and awareness in recovery

FUNDING REQUIRED: \$350

INDICATION OF POTENTIAL IN-KIND CONTRIBUTION: \$4,657.50

PARTICIPATION

Action 5a: Work with the District Council of Lower Eyre Peninsula (DCLEP) to manage Aleppo Pine regeneration at the corner of Wattle Drive and Charlton Gully Road.

The Aleppo Pines at this particular site (Site 223 in Way 2006) were a critical feeding site before the 2005 fire. Although the Aleppo Pines at this site were all burnt and died in the 2005 fire, they are still standing. The Recovery Team should ensure that the DCLEP and EPNRMB understands the

importance of this site for cockatoo conservation and aim to be involved in and/or informed of any management decisions at the site. Specifically, seek to retain at least ten regenerating Aleppo Pines naturally regenerating from seed stock at this site.

Priority: Medium

Timeframe: Ongoing.

Allocation: DEH

Action 5b: Collaborative management of Aleppo Pine seedlings from particular known Aleppo Pine feed trees in the southern range.

Continue to collaborate with other land managers (E.g. local councils and SA Water) and volunteer groups such as Friends of Parks, MOCAMP, Green Corps and Australian Trust for Conservation Volunteers to monitor Aleppo Pine infestation risk at sites shown in Table 11 and as outlined in DEH 2004.

Priority: Medium

Timeframe: Ongoing on needs basis.

Allocation: DEH, EPNRMB, SA Water, Green Corps Team and volunteer groups.

Table 11 Aleppo Pine feeding sites for monitoring

SITE	LOCATION (WGS84, 53H)	LAND MANAGER	Task
Roadside: Corner Wattle Drive & Charlton Gully Road	567165, 6176756	District Council of Lower Eyre Peninsula (DCLEP)/EPNRMB	Retain one row of juvenile regenerating Aleppo Pines for replacement food trees in collaboration with DCLEP. Remove remaining Aleppo Pine seedlings at site. Monitor adjacent east and west roadsides for 200m to the south & remove Aleppo Pine seedlings.
Roadside: Charlton Gully Road west of Wattle Drive intersection	567323, 6176831	District Council of Lower Eyre Peninsula/EPNRMB	Remove Aleppo Pine seedlings at site. Monitor adjacent north and south roadsides for 200m to the east and west & remove Aleppo Pine seedlings.
Uley Basin	561229 6166689 559100 6168891 559145 6168899 559097 6168875 559597 6169582 559857 6169780 559556 6167785 559543 6167858 559160 6168743	SA Water	Remove Aleppo Pine seedlings at sites.
Flinders Highway Roadside opposite 'The Fountain'	557536, 6171634 557543 6171711	District Council of Lower Eyre Peninsula/EPNRMB	Monitor north and south roadsides(Flinders Highway) adjacent to The Fountain for 200m to the east and west & remove Aleppo Pine seedlings for five years from 2004 or until grazing arrangement from Native Vegetation Council has ceased (DEH 2004)

Action 5c: Foster research opportunities and projects with tertiary institutions.

Possible focus for research projects include:

1. Continue genetic analysis of bottlenecks and variability within the Eyre Peninsula population*.
2. Behavioural studies of captive-bred juveniles to reduce chicks becoming habituated to humans*.
3. Animal husbandry procedures to foster recognition of native Eyre Peninsula food resources in captive-bred juveniles*.
4. Animal husbandry procedures to foster predator awareness.
5. Further nutritional analysis of food resources* (See Way 2006).
6. Microclimate of natural hollows versus poly-pipe nest boxes*.
7. Selection of Aleppo Pine feed trees.
8. Life cycle of burrowing moth larvae *Meyriccia latro*.
9. Fit "dummy" transmitters to captive bred juveniles to monitor behavioural responses and effects.
10. Radio-telemetry of first year wild juveniles to investigate habitat use.

* indicates priority research projects.

Priority: Medium

Timeframe: Ongoing.

Allocation: DEH and various tertiary institutions.

Action 5d: Increase the capacity of landholders and community groups to become more involved in private land conservation.

EPNRM and DEH staff work to ensure community members are aware of opportunities in private land conservation and support their capacity to become involved in:

- Grant applications (e.g. Envirofund, Threatened Species Network, Wildlife Conservation Fund)
- Heritage Agreements

Priority: Medium

Timeframe: Ongoing

Allocation: DEH in association with EPNRMB.

Action 5e: Continue to distribute and promote the use of "Cocky Diary" across the Eyre Peninsula.

Distribution of diaries to landholders in the southern range occurs in October and April in the north.

Priority: Medium

Timeframe: Ongoing

Allocation: DEH and volunteers.

Action 5f: Continue coordinating and managing volunteer events and activities associated with cockatoo recovery.

Volunteer activities are shown in Table 9. Train volunteers both to assist with project at the Gorge Wildlife Park and Adelaide Zoo, as well as on Eyre Peninsula. Eyre Peninsula volunteer teams could be formed to conduct and monitor supplementary feeding sites in the breeding area (Action 5a, Section 5.2.2).

Priority: Medium

Timeframe: Ongoing

Allocation: DEH and DEH contractor or volunteers.

Table 12 Volunteer opportunities associated with Eyre Peninsula Yellow-tailed Black-Cockatoo recovery

ACTIVITY	WHERE	WHEN
Filling in Cockey Diaries	North & south	North: April-October South: October-April
Collect & distribute pine cones for supplementary feeding	South	November-March
Dusk Nest Watches	South	November-December
Hakea revegetation	South	June-August
Hakea propagation	South	September-October

Action 5g: Invite local revegetation experts onto Recovery Team

Revegetation specialists can bring important experience with revegetation to planning onground works and direct seeding trials, as well as providing feedback on failed revegetation sites. DEH to facilitate revegetation professional involvement into Recovery Team.

Priority: Medium

Timeframe: 2008

Allocation: DEH

AWARENESS

Action 5h: Identify Aleppo Pine feed trees in the northern habitat range with private landholders.

Ensure landholders understand the importance of Aleppo Pine food trees and agree to retain them in key areas.

Priority: Medium

Timeframe: Winter 2009

Allocation: DEH

Action 5i: Produce regular media releases and opportunities.

Department for Environment and Heritage, in association with Gorge Wildlife Park and Adelaide Zoo, to promote project activities at least four times a year. The following occasions and activities have been historically targeted for media releases:

- Threatened Species Day: annually in September
- Biodiversity Month: annually in September
- Eyre Peninsula Field Days: every two years
- Commencement/ conclusion of breeding
- Commencement/ conclusion of summer/winter migration and census

Priority: Medium

Timeframe: Ongoing

Allocation: DEH

5.2.6 Objective 6: Bolster wild population through population supplementation²

FUNDING REQUIRED: \$3,920.00

INDICATION OF POTENTIAL IN-KIND CONTRIBUTION: \$13,867.50

DEVELOPMENT OF POPULATION SUPPLEMENTATION PROPOSAL

Action6a: Apply the “Pre-application checklist for early assessment of translocation³ proposals”, as outlined in the draft document *Translocations of Native Fauna Policy* (DEH 2006a).

Priority: Urgent

Timeframe: December 2008

Allocation: DEH

Action6b: Develop a translocation proposal as outlined in the draft document: *Translocations of Native Fauna Procedure* (DEH 2006b).

Successful population supplementation requires the enhancement and protection of habitat to reduce, remove or manage for the threats are causing decline of the existing population. Re-stocking introduction⁴ and/or translocation of Yellow-tailed Black-Cockatoos to the Eyre Peninsula will depend on the successful application of the following Actions:

EXPAND, ENHANCE AND PROTECT EXISTING HABITAT (Section 5.2.1)

- Action 1g: Protect and manage selected Aleppo Pine stands on lower Eyre Peninsula.
- Action 1h: Strategic allocation of fencing incentives in the cockatoo breeding area.

INCREASE AVAILABILITY OF NATIVE FOOD RESOURCES IN SOUTHERN RANGE (Section 5.2.2)

- Action 2a: Continue to create concentrated areas of native food resources through revegetation with *Hakea rugosa*, *H. cycloptera* and *Xanthorrhoea semiplana* tube stock at prioritised sites in the breeding area.
- Action 2b: Trial direct seeding of *H. rugosa* and *H. cycloptera*.

Despite concerted revegetation efforts since 1998 the 2005 fires, there is considerable time-lag (e.g. 3-4 years) involved in revegetated hakea tube stock reaching sexual maturity and providing cones for Yellow-tailed Black-Cockatoo forage. The 2005 revegetation sites assessed in May 2008 were not yet coning and were not contributing Yellow-tailed Black-Cockatoo food resources three years after planting. The time taken for hakea plants to produce cones will vary slightly depending on the quality of the site and fluctuation of annual rainfall. Due to the habitual feeding behaviour of the wild flock, it may take several seasons and/or generations for the birds to locate and learn to use areas of new forage (Way 2006).

Continuation of the current revegetation program is critical if the habitat is to support additional Yellow-tailed Black-Cockatoos. Frequency of re-stocking introduction and/or translocation events will need to be managed to coincide with increased availability of food resources and habitat.

Current genetic data confirms that the Eyre Peninsula population is not a unique subspecies but is representative of the *C. f. whitei* complex (J Norman, *in prep*). Consequently, re-stocking using birds sourced from other South Australian populations rather than exclusively from the Gorge Wildlife Park captive population may now be considered without compromising unique genetic traits.

This raises new questions for Yellow-tailed Black-Cockatoo recovery on Eyre Peninsula using re-stocking. Based on the current genetic data, there are four main options for sourcing Yellow-tailed Black-Cockatoos to supplement the wild population on Eyre Peninsula. Each of these will have

² Population supplementation: Additional individuals of a species are moved into an area occupied by low numbers of that species for the purpose of improving genetic diversity, increasing population productivity, and/or decreasing the risk of extinction (DEH 2006c)

³ Translocation: the deliberate movement of an indigenous species from one location to another for the purposes of conservation. A translocation may be a new introduction, a re-introduction or a population supplementation (DEH 2006c)

⁴ Re-stocking reintroduction: Supplementing a declining population with captive bred stock (after Burgman and Lindenmayer 1998)

different outcomes concerning Eyre Peninsula Yellow-tailed Black-Cockatoo conservation from a genetics point of view and are discussed below.

Option 1: Re-stocking reintroduction

Using only captive bred individuals to re-stock the Eyre Peninsula population will ensure similar genetic profiles to the wild population (i.e. genetic profiles with high frequency gene introgression from *funereus*).

Option 2: Translocation using birds from South Australian mainland populations.

Finalisation of outstanding genetic analysis (Section 1.1.2 and 3.5) will identify the preferred source/s of translocated birds from South Australian populations (Mount Lofty Ranges, Kangaroo Island and south east South Australia) to maximize genetic variability. This may also involve sourcing injured Yellow-tailed Black-Cockatoos from around South Australia for rehabilitation and subsequent release onto Eyre Peninsula.

Option 3: Translocation using birds from Kangaroo Island.

Kangaroo Island individuals should be translocated to Eyre Peninsula if the priority is to re-establish a mainland *whitei* population.

Option 4: Re-stocking reintroduction and translocation.

Subject to the results of genetic analysis (Section 1.1.2 and 3.5), supplement the Eyre Peninsula population using both captive-bred individuals and individuals from other South Australian populations.

Priority: Urgent

Timeframe: December 2008

Allocation: DEH

The below Actions are only relevant if the Yellow-tailed Black-Cockatoo translocation proposal (Action 6b) is approved by the DEH Manager, Biodiversity Conservation Programs.

RE-STOCKING REINTRODUCTION

Action 6c: Confirm aviary space for captive-bred juveniles post-fledging.

Priority: Urgent

Timeframe: Before the end of the 2008/2009 breeding season.

Allocation: Potentially Adelaide Zoo in association with Gorge Wildlife Park and DEH.

Action 6d: Determine best post-fledging feeding techniques for captive bred juveniles to minimise human habituation.

Priority: Urgent

Timeframe: Coinciding with the 2008/2009 breeding season (See also Section 5.2.5, Action 5c), dependant on captive-bred chicks

Allocation: Potentially Adelaide Zoo in association with Gorge Wildlife Park and DEH.

Action 6e: Obtain genetic profiles and microchip all captive-bred juveniles at fledging.

Priority: High

Timeframe: Ongoing from successful fledging of first captive-bred juvenile.

Allocation: Previously Museum Victoria , Adelaide Zoo and Gorge Wildlife Park.

Action 6f: Develop hygiene protocols for bird movement between Eyre Peninsula, Gorge Wildlife Park and Adelaide Zoo.

Hygiene and quarantine issues need to be addressed by DEH, Adelaide Zoo and Gorge Wildlife Park for the following scenarios:

1. Movement of fledged captive-bred juveniles to aviaries at Monarto and/or Adelaide Zoos.
2. Housing of wild Yellow-tailed Black-Cockatoos with/adjacent to captive-bred Eyre Peninsula Yellow-tailed Black-Cockatoos for imprinting of natural feeding behaviour.
3. Re-stocking of captive-bred Eyre Peninsula Yellow-tailed Black-Cockatoos to the Eyre Peninsula wild population.

Priority: High

Timeframe: Prior to the 2008/2009 breeding season.

Allocation: Adelaide Zoo in association with Gorge Wildlife Park and DEH.

Action 6g: Establish *Hakea* harvest bushes at Adelaide Zoo for feeding captive-bred juveniles.

Hakea cycloptera and *Hakea rugosa* seed was supplied to Adelaide Zoo horticultural department in August 2007 for propagation into tube stock. This is the initial step to produce native food plants for harvesting to feed captive-bred cockatoos.

Priority: High

Timeframe: Before the end of the 2008/2009 breeding season (See also Section 5.2.5, Action 5c)

Allocation: Adelaide Zoo in association with DEH.

TRANSLOCATION

The feasibility of Action 6h is dependant on the results of further genetic analysis.

Action 6h: Investigate the feasibility of releasing injured and rehabilitated Yellow-tailed Black-cockatoos from South Australian populations onto Eyre Peninsula.

This technique has been used in Western Australia to aid White-tailed Black-Cockatoo recovery. A similar approach could be applied in South Australia whereby a state-wide call is broadcast around veterinary and licensed wildlife carer networks for any injured Yellow-tailed Black-Cockatoos to be brought to the Adelaide Zoo for rehabilitation and release in to the Eyre Peninsula population.

This process is opportunistic and will not secure a regular supply of Yellow-tailed Black-Cockatoos for translocation. Therefore, it may be a procedure that can supplement a specific translocation event or re-stocking re-introduction.

Priority: Dependant on genetic results, low.

Timeframe: Dependant on genetic results

Allocation: Potentially Adelaide Zoo in association with DEH.

5.2.7 Objective 7: Support, Coordinate and Review Recovery Activities

FUNDING REQUIRED: \$10,164.75

INDICATION OF POTENTIAL IN-KIND CONTRIBUTION: \$4,281.00

Action 7a: Annual update of the following databases, maintained at the Port Lincoln office of the Department for Environment and Heritage:

1. **Primary observation.** All cockatoo records from census, monitoring, Cocky Diaries and reports from community members. Data fields include specific to the project as well as minimum dataset requirements as specified by the Department for Environment and Heritage's Biological Database, South Australia (BDBSA) Data to be loaded annually into the BDBSA. To facilitate consistency in recording, a Cockatoo Observation datasheet has been developed and generic GPS points of repeatedly visited sites and known nest sites are listed on the back of the template and should be used for database entries when appropriate. A modified version of the datasheet (for privacy reasons) is shown in Appendix D.
2. **Nest database and history.** New nests recorded and all active nests noted each breeding season including reasons for success/failure.
3. **Nest monitoring.** Raw data from nest monitoring field trips, including chick measurements and weights.
4. **Egg salvage.** Nests from where eggs were salvaged and the outcome of those eggs after incubation at the Gorge Wildlife Park.
5. **Leg band data.** New leg bands used and re-sights of individually banded birds (pulled from *Primary Observation* database)

Priority: High

Timeframe: Ongoing.

Allocation: DEH.

Action 7b: Transfer project data from current excel databases into ACCESS database for more efficient storage, analysis and retrieval.

An original database was designed prior to 2004 by S. Pillman but was not added to due to design faults and lack of staff training. This database should be referred to prior to re-building a new database.

Priority: High

Timeframe: December 2009

Allocation: DEH

Action 7c: Continue recovery team meetings and annually review project activities.

Recovery team meetings to be held at least three times per year: March/April, July/August and October/November.

Priority: High

Timeframe: Ongoing, three times/year.

Allocation: Recovery Team members.

Action 7d: Fortnightly contact between Department for Environment and Heritage and Gorge Wildlife Park during the breeding season.

To ensure Gorge Wildlife staff is given sufficient notice before nest monitoring activities to prepare for potential incubation of salvaged eggs and to keep DEH field staff up to date with development of salvaged eggs.

Priority: High

Timeframe: Ongoing

Allocation: DEH and Gorge Wildlife Park.

Action 7e Actively pursue variety of funding opportunities.

Apply for funding through a variety of sources including: Threatened Species Network, Nature Foundation SA, Wildlife Conservation Fund, Envirofund, private donations, Department for Environment and Heritage and Eyre Peninsula Natural Resources Management Board

Timeline: Ongoing

6 RECOVERY PLAN COST

6.1 Past funding sources

In the past, the project has been supported by a variety of grants and funding bodies:

1990's-2004 Department for Environment and Heritage contributions from budgets for Regional Investigator, Bush Management Advisors, Eyre Peninsula Yellow-tailed Black-cockatoo Project Officer and Ark On Eyre positions.

1998 Clipsal , administrated by Nature Foundation SA

2002 Wildlife Conservation Fund

2003 Envirofund

2004 Federal Government Natural Heritage Trust and supported by the Eyre Peninsula Natural Resources Management Board

2005-2006 Federal and State Government: Lower Eyre Peninsula Bushfire Re-establishment Program

2005-2006 Nature Foundation SA Bushfire Recovery Appeal

2005 Rotary ROBIN program

Proportions of the budgets from the following Eyre Peninsula Natural Resources Management Board projects (NHT funded) were allocated to Eyre Peninsula Yellow-tailed Black-Cockatoo recovery project activities:

2004/2005: Threatened Species Recovery

2005/2006: Strategic Biodiversity - Part 4 Threatened Fauna Recovery on Eyre Peninsula

2006/07: Threatened Fauna Recovery, Eyre Peninsula

2007/2008: Habitat Management for Species Survival

6.2 Recovery Plan Budget

The budget to deliver the Recovery Plan's objectives for one year is shown in Table 13.

Things to note:

While budgeting aims to be as representative as possible, some changes in prices and rates will be incurred depending on the timing of implementation compared to the production of this plan.

In-kind involvement from staff from the Gorge Wildlife Park and Zoos SA is indicative and may not reflect the true capacity of involvement. Estimates are based on planning discussions and liaison with staff undertaken in the forum of Eyre Peninsula Yellow-tailed Black-Cockatoo Recovery Team Meetings.

Baseline Operating costs are presented first and include a wage for a full time Project Officer budgeted for at the DEH Professional Service Officer rate (Level2 Step1). The Project Officer could be sponsored by a number of agencies (e.g. EPNRM, DWBLC, Zoos SA). DEH is presented as the employer as an example only. The Project Officer will contribute to many actions throughout the seven objectives. The Project Officer costs are presented as a bulk amount and the budget is not broken down for each action but rather noted as allocated to that action in the table.

Vehicle costs are estimated based on current State Government long-term hire costs as offered by Fleet SA.

In response to the challenge of securing long-term funding, a triage approach is identified by highlighting those actions considered to be the minimum required to maintain the current situation.

Table 13 Recovery Plan Budget

* Cost has been estimated

DESCRIPTION OF COSTS (All costs GST Inclusive)	FUNDS REQUIRED	DEH (In-kind)	GORGE WILDLIFE PARK (In-kind)	ZOOS SA (In-kind)	EPNRM (In-kind)	VOLUNTEERS (In-kind)
BASELINE OPERATING						
Project Officer & employment costs						
1 x FTE (POS2, Level1), to undertake various actions as specified in Section 5.2 and listed below	\$85,491.02					
Vehicle hire, fuel & maintenance	\$12,764.00					
BASELINE OPERATING SUBTOTAL	\$98,255.02	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
OBJECTIVE 1: MAXIMISE SURVIVAL AND RECRUITMENT OF BIRDS IN WILD						
Action 1a: Continue nest location						
Project Officer time (included in Project Officer costs)						
Volunteers: 8 people for 4hours ea over 4 nights @ \$30/hr (Volunteer activity: Dusk Nest Watches Table 9)						\$3,840.00
Action 1b: Continue nest monitoring						
Project Officer time (included in Project Officer costs)						
Contractor to assist with climbing: 10days @ \$224.28/day	\$2,242.80					
DEH Threatened Fauna Ecologist, bird-banding expertise 30hrs @ \$33/hr (Assume 2 x 2day trips)		\$990.00				
DEH Threatened Fauna Ecologist 2 x return airfares Adelaide-Port Lincoln @ \$298 ea	\$596.00					
DEH Threatened Fauna Ecologist 2 x 1 night's accommodation & food @ \$180/night	\$360.00					
Action 1c: Continue nest protection						
Project Officer time (included in Project Officer costs)						
Consumables: corrugated iron & nails.	\$330.00					

DESCRIPTION OF COSTS (All costs GST Inclusive)	FUNDS REQUIRED	DEH (In-kind)	GORGE WILDLIFE PARK (In-kind)	ZOOS SA (In-kind)	EPNRM (In- kind)	VOLUNTEER (In-kind)
Action 1d: Develop a mechanism to close poly pipe nest boxes for the winter to discourage nesting of non-target species (e.g. galahs and starlings).						
Project Officer time (included in Project Officer costs)						
Contractor to assist with climbing: 5days @ \$224.28/day	\$1,121.40					
1x DEH Construction & Maintenance Worker (Level4), 3 days @ 19.21/hr		\$432.25				
Consumables: hinges, materials.	\$220.00					
Action 1e: Annual monitoring and maintenance of nest trees.						
Project Officer time (included in Project Officer costs)						
Contractor: 10days @ \$224.28/day	\$2,242.80					
Consumables: corrugated iron, nails, nuts & bolts, insecticide, safety clothing, batteries, red gum chips	\$880.00					
Action 1f: Destroy Galah (<i>Eolophus roseicapillus</i>) breeding pairs that have established in known Yellow-tailed Black-Cockatoo hollows and poly-pipe nest boxes.						
Project Officer time (included in Project Officer costs)						
1 X DEH Senior Ranger (OPS4, Level3) , 2 days @ \$28.41/hr		\$426.15				
Action 1g: Protect and manage selected Aleppo Pine stands on lower Eyre Peninsula.						
Project Officer time (included in Project Officer costs)						
Action 1h: Strategic allocation of fencing incentives in the cockatoo breeding area.						
Project Officer time (included in Project Officer costs)						
1 x EPNRM Officer, 37.5 hrs @ \$28*/hr					\$1,050.00	
Approx 7km fencing achieved, @ \$3696/km	\$25,872.00					
Action 1i: Strategic direct seeding in the cockatoo breeding area.						
Contractor: Approx 12km direct seeding achieved @ \$220/km	\$2,640.00					
OBJECTIVE 1 SUBTOTAL	\$36,505.00	\$1,848.40	\$0.00	\$0.00	\$1,050.00	\$3,840.00

DESCRIPTION OF COSTS (All costs GST Inclusive)	FUNDS REQUIRED	DEH (In-kind)	GORGE WILDLIFE PARK (In-kind)	ZOOS SA (In-kind)	EPNRM (In-kind)	VOLUNTEERS (In-kind)
OBJECTIVE 2: RE-ESTABLISH FOOD RESOURCES AND EXPANSION OF HABITATS						
Action 2a: Continue to create concentrated areas of native food resources through revegetation with <i>Hakea rugosa</i>, <i>H.cycloptera</i> and <i>Xanthorrhoea semiplana</i> tubestock at prioritised sites						
Project Officer time (included in Project Officer costs)						
Contractor: produce 3000 x tubestock @ \$1.50 ea	\$4,500.00					
Contractor: Site preparation, 2 people x 2days @ \$49.50/hr plus travel	\$1,116.00					
Volunteers to help with revegetation: 6 people for 2 days ea @\$25/hr						\$2,250.00
Volunteers to help with propagation of tubestock: 6 people for one day @\$25/hr						\$1,125.00
30g <i>Hakea cycloptera</i> and 30g of <i>Hakea rugosa</i> seed @ \$2.75/g	\$165.00					
Action 2b: Trial direct seeding of <i>H. rugosa</i> and <i>H. cycloptera</i>.						
Contractor: Approx 5km direct seeding achieved @ \$220/km	\$1,100.00					
Action 2c: Continue with established Aleppo Pine supplementary feeding stations.						
Project Officer time (included in Project Officer costs)						
Volunteers 2 people 5 days ea @ \$25/hr (Volunteer Activity: collect & supply pine cones, Table 9)						\$250.00
Travel allowance for volunteers 10 trips at 80km/trip @ 0.56cents/km	\$448.00					
OBJECTIVE 2 SUBTOTAL	\$7,329.00	\$0.00	\$0.00	\$0.00	\$0.00	\$3,625.00

DESCRIPTION OF COSTS (All costs GST Inclusive)	FUNDS REQUIRED	DEH (In-kind)	GORGE WILDLIFE PARK (In-kind)	ZOOS SA (In-kind)	EPNRM (In-kind)	VOLUNTEERS (In-kind)
OBJECTIVE 3: CONTINUE TO MANAGE AND INCREASE <i>EX SITU</i> POPULATION						
<u>Action 3a</u> Recover 'surplus' eggs to <i>ex situ</i> population						
Project Officer time (included in Project Officer costs)						
Courier for egg transport to Adelaide x 3 @ \$45 ea	\$135.00					
<u>Action 3b</u> Apply baseline captive rearing hygiene protocols in association with Gorge wildlife Park						
<u>Action 3c</u> Record Salvaged egg development data						
<u>Action 3d:</u> Reassess current pairing of birds in response to results of genetic relatedness coefficients (R) from Museum Victoria						
<u>Action 3e:</u> Modify nest boxes to allow <i>in situ</i> monitoring of eggs						
<u>Action 3f:</u> Provide choice of nest boxes in breeding aviaries.						
<u>Action 3g:</u> Procedure established for monitoring captive-laid eggs						
Project Officer time (included in Project Officer costs) and Gorge Wildlife Park staff x1. (Actions 3b-3g). Estimation of costs associated with housing adult EPYTBCs and hand-rearing salvaged chicks including: incubation, feeding, food prep, food purchase, data recording is approx \$880/bird/year and \$880/bird/year in labour costs (Steve McKecknie, Gorge Wildlife Park, pers. comm.) 12 birds (August 2008) and assumed 1 salvaged chick /year = 13 birds			\$22,880.00			
<u>Action 3h:</u> Continue to maintain studbook of captive population.						
Zoos SA 1x Zoo Keeper 5 hrs @ \$25/hr				\$125.00		
<u>Action 3i:</u> Procedure established for feeding captive-bred chicks pre-fledging.						
Refer to Gorge Wildlife Park contributions for actions Action 3b-3g						
<u>Action 3j:</u> Develop and apply baseline health checks for captive population						
Zoos SA 1 X Veterinary staff 1 check/year @ \$500*/check				\$500.00		
OBJECTIVE 3 SUBTOTAL	\$135.00	\$0.00	\$22,880.00	\$625.00	\$0.00	\$0.00

DESCRIPTION OF COSTS (All costs GST Inclusive)	FUNDS REQUIRED	DEH (In-kind)	GORGE WILDLIFE PARK (In-kind)	ZOOS SA (In-kind)	EPNRM (In-kind)	VOLUNTEERS (In-kind)
OBJECTIVE 4: IMPROVE BIOLOGICAL KNOWLEDGE						
Action 4a: Confirm the degree of genetic variation and relatedness between and within South Australia's Yellow-tailed Black-Cockatoo populations.						
Currently funded						
Action 4b: Obtain genetic profiles and R values (Relatedness) of all future salvaged Eyre Peninsula Yellow-tailed Black-Cockatoo chicks.						
Contractor: genetic profile of chicks approx \$77/bird. Estimate 2 salvaged birds/year	\$154.00					
Action 4c: Conduct nutritional analysis of diet fed to captive colony.						
Contractor: Based on quotes for nutritional analysis (National Measurement Institute)	\$1,500.00					
Action 4d: Autopsies to be carried out on all deceased individuals.						
Zoos SA Veterinary staff 1 autopsy/year @ \$500*/ autopsy				\$500.00		
Action 4e: Continue summer and winter population census.						
Project Officer time (included in Project Officer costs)						
EPYTBC monitoring conducted by community.20 people for 7.5 hrs ea @\$25/hour. (Volunteer Activity: Cocky Diaries, Table 9)						\$11,250.00
Project Officer accommodation costs & food for 4 day winter monitoring trip @ \$180/night	\$720.00					
OBJECTIVE 4 SUBTOTAL	\$2,374.00	\$0.00	\$0.00	\$500.00	\$0.00	\$11,250.00

DESCRIPTION OF COSTS (All costs GST Inclusive)	FUNDS REQUIRED	DEH (In-kind)	GORGE WILDLIFE PARK (In-kind)	ZOOS SA (In-kind)	EPNRM (In- kind)	VOLUNTEER S (In-kind)
OBJECTIVE 5: PROMOTE COMMUNITY AND STAKEHOLDER PARTICIPATION AND AWARENESS IN RECOVERY						
Action 5a: Work with the District Council of Lower Eyre Peninsula (DCLEP) to manage Aleppo Pine regeneration at the corner of Wattle Drive and Charlton Gully Road.						
Project Officer time (included in Project Officer costs)						
Action 5b: Annual inspection and removal of seedlings from particular known Aleppo Pine feed trees in the southern range						
Project Officer time (included in Project Officer costs)						\$1,600.00
Volunteers: 8 people for 8 hours ea @ \$25/hr (Previous Green Corps Teams)						
Action 5c: Foster research opportunities and projects with tertiary institutions.						
Project Officer time (included in Project Officer costs)		\$945.00				
DEH Senior Threatened Species Ecologist 22.5 hrs @ \$42/hr						
Action 5d: Increase the capacity of landholders and community groups to become more involved in private land conservation.						
Project Officer time (included in Project Officer costs)						
EPNRM officer 37.5 hrs @ \$28/hr					\$1,050.00	
Action 5e: Continue to distribute and promote the use of "Cocky Diary" across the Eyre Peninsula.						
Project Officer time (included in Project Officer costs)						
1 volunteer (M. Jericho) 3 days @ \$25/hr						\$562.50
Incidental expenses for M. Jericho volunteer. Telephone, postage, photocopying, travel.		\$350.00				
Action 5f: Continue to coordinate & manage volunteer activities associated with cockatoo recovery.						
Project Officer time (included in Project Officer costs)						
Action 5g: Invite local revegetation experts onto Recovery Team						
Project Officer time (included in Project Officer costs)						

DESCRIPTION OF COSTS (All costs GST Inclusive)	FUNDS REQUIRED	DEH (In-kind)	GORGE WILDLIFE PARK (In-kind)	ZOOS SA (In-kind)	EPNRM (In- kind)	VOLUNTEER S (In-kind)
<p>Action 5h: Identify Aleppo Pine feed trees in the northern habitat range with private landholders. Project Officer time (included in Project Officer costs) Landholder volunteer involvement, approximately 10 landholders for 2 hours each @ \$25/hr</p> <p>Action 5i: Produce regular media releases and opportunities. Project Officer time (included in Project Officer costs)</p>						\$500.00
OBJECTIVE 5 SUBTOTAL	\$350.00	\$945.00	\$0.00	\$0.00	\$1,050.00	\$2,662.50

DESCRIPTION OF COSTS (All costs GST Inclusive)	FUNDS REQUIRED	DEH (In-kind)	GORGE WILDLIFE PARK (In-kind)	ZOOS SA (In-kind)	EPNRM (In-kind)	VOLUNTEER S (In-kind)
OBJECTIVE 6: BOLSTER WILD POPULATION THROUGH POPULATION SUPPLEMENTATION						
Action6a: Apply the "Pre-application checklist for early assessment of translocation proposals", as outlined in the draft document Translocations of Native Fauna Policy (DEH 2006a).						
Project Officer time (included in Project Officer costs)		\$1,192.50	\$247.50	\$247.50		
Technical support:						
DEH: Manager Conservation Programs(West) 15 hrs @ \$42/hr						
Senior Threatened Species Ecologist 7.5hrs @ \$42/hr						
State Threatened Fauna Ecologist 7.5 hrs @ \$33/hr.						
Zoos SA: Senior Curator: Birds 7.5 hrs @ \$80/hr.						
Gorge Wildlife Park Staff x1 7.5 hrs @ \$33 /hr						
Action6b: Develop a translocation proposal as outlined in the draft document: <i>Translocations of Native Fauna Procedure</i> (DEH 2006b).						
Project Officer time (included in Project Officer costs)		\$1,755.00	\$247.50	\$1,095.00		
DEH technical support: Manager Conservation Programs (West) 15 hrs @ \$42/hr						
Senior Threatened Species Ecologist 15 hrs @ \$42/hr						
State Threatened Fauna Ecologist 15 hrs @ \$33/hr.						
Zoos SA: Senior Curator: Birds 15 hrs @ \$33/hr, Veterinary staff x1 7.5 hrs @ \$80*/hr						
Gorge Wildlife Park Staff x1 7.5hrs @ \$33/hr						
1 X return airfare Port Lincoln - Adelaide for Project Officer time (included in Project Officer costs) @ \$298 ea	\$298.00					
Accommodation & food allowances for 1 night @ \$180/night	\$180.00					

DESCRIPTION OF COSTS (All costs GST Inclusive)	FUNDS REQUIRED	DEH (In-kind)	GORGE WILDLIFE PARK (In-kind)	ZOOS SA (In-kind)	EPNR M (In- kind)	VOLUNTEER S (In-kind)
Action 6c: Confirm aviary space for captive-bred juveniles post-fledging.						
Project Officer time (included in Project Officer costs) Technical support: DEH Senior Threatened Species Ecologist 15 hrs @ \$42/hr. Zoos SA Senior Curator: Birds 15 hrs @ \$32/hr Gorge Wildlife Staff x1 15hrs @ \$32/hr		\$630.00	\$480.00	\$480.00		
Action 6d: Determine best post-fledging feeding techniques for captive bred juveniles to minimise human habituation.						
Project Officer time (included in Project Officer costs) Technical support: DEH State Threatened Fauna Ecologist 37.5 hrs @ \$33/hr. Zoos SA Senior Curator: Birds 37.5 hrs @ \$32/hr Gorge Wildlife Staff x1 37.5 hrs @ \$32/hr		\$1,237.50	\$1,200.00	\$1,200.00		
Action 6e: Obtain genetic profiles and microchip all captive-bred juveniles at fledging.						
Gorge Wildlife Staff x 1 7.5 hours @ \$32/hr Zoos SA veterinary staff x1 7.5 hours @ \$80/hr 2 x microchips \$30 ea			\$240.00	\$240.00		
Contractor: Genetic profiles (assume two fledglings/yr) 2 @ \$77 ea	60.00					
	\$154.00					
Action 6f: Develop hygiene protocols for bird movement between Eyre Peninsula, Gorge Wildlife Park and Adelaide Zoo.						
Project Officer time (included in Project Officer costs) Technical support: Zoos SA Veterinary staff x1 15 hrs @ \$80/hr Gorge Wildlife Staff x1 15 hrs @ \$32/hr			\$480.00	\$1,200.00		

DESCRIPTION OF COSTS (All costs GST Inclusive)	FUNDS REQUIRED	DEH (In-kind)	GORGE WILDLIFE PARK (In-kind)	ZOOS SA (In-kind)	EPNR M (In- kind)	VOLUNTEER S (In-kind)
Action 6g: Establish <i>Hakea</i> harvest bushes at Adelaide Zoo for feeding captive-bred juveniles.						
Project Officer time (included in Project Officer costs)						
Zoos SA Horticultural staff 37.5 hrs @ \$32/hr						
1 X return airfare Port Lincoln - Adelaide for Project Officer time (included in Project Officer costs) @ \$298 ea	\$298.00					
Accommodation & food allowances for 1 night @ \$180/night	\$180.00					
Hakea seed 1kg @ \$2750 /kg	\$2,750.00					
Action 6h: Investigate the feasibility of releasing injured and rehabilitated Yellow-tailed Black-cockatoos from South Australian populations onto Eyre Peninsula.						
Project Officer time (included in Project Officer costs)		\$495.00		\$1,200.00		
Technical support:						
DEH Threatened Fauna Ecologist 15 hrs @ \$33/hr.						
Zoos SA Veterinary staff 15 hrs @ \$80/hr						
OBJECTIVE 6 SUBTOTAL	\$3,920.00	\$5,310.00	\$2,895.00	\$5,662.50	\$0.00	\$0.00

OBJECTIVE 7. SUPPORT, COORDINATE & REVIEW RECOVERY ACTIONS							
Action 7a: Annual update of five databases, maintained at the Port Lincoln office of the Department for Environment and Heritage							
Project Officer time (included in Project Officer costs)							
DEH Technical support: \$1,125.00							
GIS Officer (produce & update GIS layers & maps) approx 3 days @\$375/day							
Volunteer x1 30hrs @ \$25/hr \$750.00							
Action 7b: Transfer project data from current excel databases into ACCESS database for more efficient storage, analysis and retrieval.							
Database contractor 30 days @ \$37.23/hr (based on DEH Technical Services stream,TGO5Level3). \$8,376.75							
Action 7c: Continue recovery team meetings and annually review project activities.							
Assume three meetings/yr @ 3 hours ea \$1,053.00 \$247.50 247.5							
Project Officer time (included in Project Officer costs)							
DEH staff Manager Conservation Programs (West) 9 hrs @ \$42/hr							
Senior Ecologist Threatened Species 9hrs @ \$42/hr							
State Threatened Fauna Ecologist 9 hrs @ \$33/hr							
Zoos SA Senior Curator: Birds 9 hrs @ \$33/hr							
Gorge wildlife Park Staff x1 9hrs @ \$33/hr							
3 x return airfares between Port Lincoln and Adelaide for 2 people @ \$298 ea \$1,788.00							
Action 7d: Fortnightly contact between Department for Environment and Heritage and Gorge Wildlife Park during the breeding season.							
Project Officer time (included in Project Officer costs) \$858.00							
Gorge Wildlife Park staff x1 26 hrs @ \$33/hr							
Action 7e Actively pursue variety of funding opportunities.							
Project Officer time (included in Project Officer costs)							
SUBTOTAL OBJECTIVE 7 \$10,164.75 \$2,178.00 \$1,105.50 \$247.50 \$0.00 \$750.00							
TOTALS OF ALL OBJECTIVES \$159,032.77 \$10,281.40 \$26,880.50 \$7,035.00 \$2,100.00 \$22,127.50							
GRAND TOTAL OF PROJECT \$227,457.17							

7 LINKS TO OTHER PLANS

Draft Recovery Plan for 23 Threatened Flora Taxa on Eyre Peninsula, South Australia (DEH 2008a).

EPYTBC Recovery Plan actions contribute to the protection of Sugar Gum woodlands, a threatened vegetation community providing habitat for several threatened flora species included in the flora Recovery Plan (Refer to Table 11, Section 8). Three threatened flora records (two Silver Daisy-bush, *Olearia pannosa* and one Tufted Bush-pea *Pultenaea trichophylla*) were identified on private land in the Koppio Hills during botanical surveys for landholders involved in cockatoo recovery (Way and Bates 2005). Specifically, EPHYTBC habitat protection efforts and weed control compliment the following flora Recovery Plan objectives and associated actions:

- Objective 3: Manage immediate threats and improve threatened flora critical habitat.

Action 3b: Reduce weed competition within threatened plants species critical habitat.

Action 3c: Reduce grazing damage to threatened plants species critical habitat.

Action 3d: Contain and prevent *Phytophthora* sp. infections.

Action 3e: Increase off reserve protection.

State Natural Resources Management Plan 2006

The Recovery Plan contributes to the following relevant policies and strategies from South Australia's State NRM Plan:

- Management of threats such as domestic grazing and vegetation clearance, phytophthora, roadside management and weed invasion
- Support the maintenance of the integrity and protection of key terrestrial parks and other conservation managed areas
- Reflect the government's commitment to the No Species Loss Strategy and NatureLinks principles.
- Strategy 1.3.3 Support recovery of threatened species and communities.
- Strategy 1.3.4 Build resilience in the landscape (by increasing functional connectivity; reducing threats and expanding the size and extent of natural habitats)
- Strategy 1.3.6 Improve and implement techniques to restore or better manage natural ecosystems and ecological processes across the landscape.
- Strategy 1.3.7 Minimise the impacts of key threatening processes (for example, the impact of invasive species).

No Species Loss: A Biodiversity Strategy for South Australia 2006-2016

The Recovery Plan delivers outcomes for three key targets identified in the Strategy including:

5 – Landscape reconstruction priorities are determined whereby ecological communities and species that are currently declining are identified. Areas where declining ecological communities and species can be maintained and improved are identified and restoration targets established.

6 – Decline in threatened species and ecological communities is halted.

7 – Recovery Plans are implemented

Weed Management Strategy. Parks of Lower Eyre Peninsula. Draft Report 2008. (DEH 2008b)

The weed management strategy is designed to compliment and enhance the management actions identified in published park management plans and the Biodiversity Plan for the Eyre Peninsula (DEH 2002). This Recovery Plan and the EPHYTBC project in general has provided guidelines for priority Aleppo Pine control throughout lower Eyre Peninsula (Way 2006), which compliments and contributes to the goals of the Weed Management Strategy.

8 BIODIVERSITY BENEFITS TO OTHER SPECIES

Recovery actions aimed at conserving the Yellow-tailed Black-cockatoo on Eyre Peninsula will also have flow-on benefits threatened Sugar Gum Woodland communities. Sugar Gum woodland communities and the flora and fauna sharing this habitat suffer many of the same threats impacting cockatoos and benefit directly from cockatoo recovery actions such as addressing fragmentation, increasing patch sizes, reducing edge effects and fencing remnants. Some other threatened species sharing this habitat are shown in Table 14.

Table 14 Other threatened species benefiting from cockatoo recovery efforts.

Common Name	Scientific Name	Conservation Status		
		SA	AUS	EP
Fauna				
Common Brushtail Possum,	<i>Trichosurus vulpecula</i>	R		
Scarlet Robin	<i>Petroica multicolor</i> ssp. boodang			V
Western Warbler	<i>Gerygone fusca</i>		R	V
Diamond Firetail	<i>Stagnopleura guttata</i>		V	V
Flora				
Feathery Wattle	<i>Acacia imbricata</i>	V	R	R
Fat-leafed wattle*	<i>A. pinguifolia</i>	E	E	E
Winter Spider-orchid*	<i>Caladenia brumalis</i>	V	V	V
Sliver Daisy-bush*	<i>Olearia pannosa</i> ssp. <i>pannosa</i>	V	V	T
Ironstone Mulla Mulla*	<i>Ptilotus beckerianus</i>	V	V	E
Tufted Bush-pea*	<i>Pultenaea trichophylla</i>	V	R	R
Metallic Sun-orchid*	<i>Thelymitra epipactoides</i>	E	E	E

* Species included in the Draft Recovery Plan for 23 Threatened Flora Taxa on Eyre Peninsula, South Australia (DEH 2008a)

9 ACKNOWLEDGEMENTS

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Appendix A : Eyre Peninsula Yellow-Tailed Black-Cockatoo Nest Database

Key:

ALT/PLACC	Aboriginal Lands Trust
CBP	Common Brushtail Possum
CGS	Nest box installed as part of the Charlton Gully Streamcare Group
D	Destroyed
DCLEP	District Council Lower Eyre Peninsula
G	Galah
LEPBRP	Nest box installed as part of the Lower Eyre Peninsula Bushfire Re-establishment Program
PLACC	Port Lincoln Aboriginal Community Council
PP	Poly-pipe nest box
OK	Okay
UNK	Unknown
R	Replaced
Status ¹	Status at April 2008
WD	Australian Wood-duck

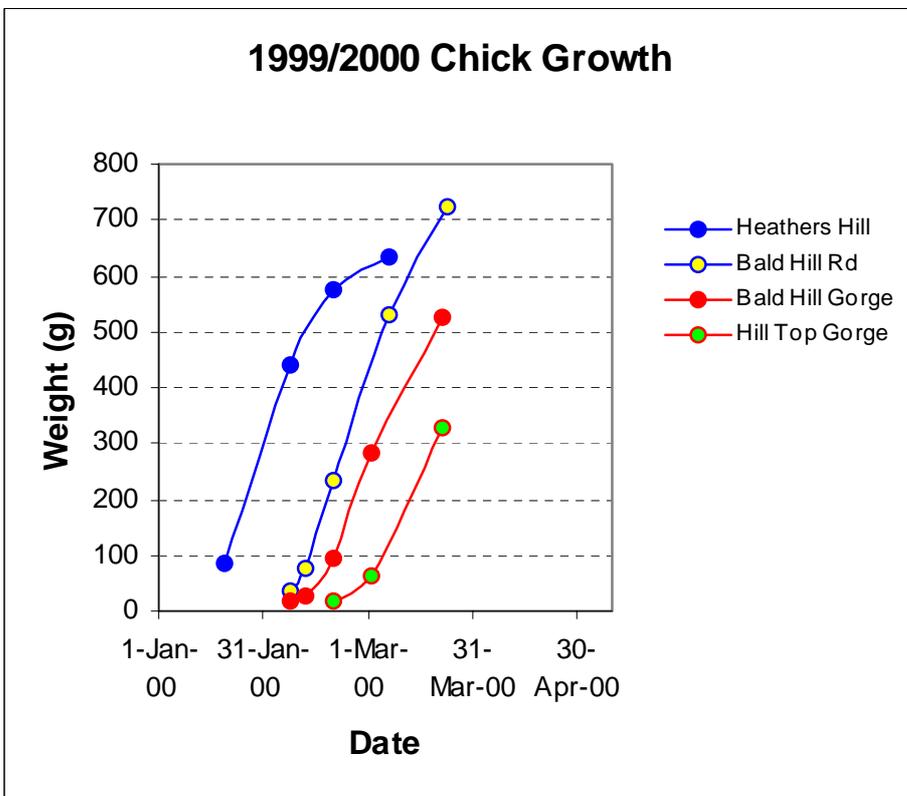
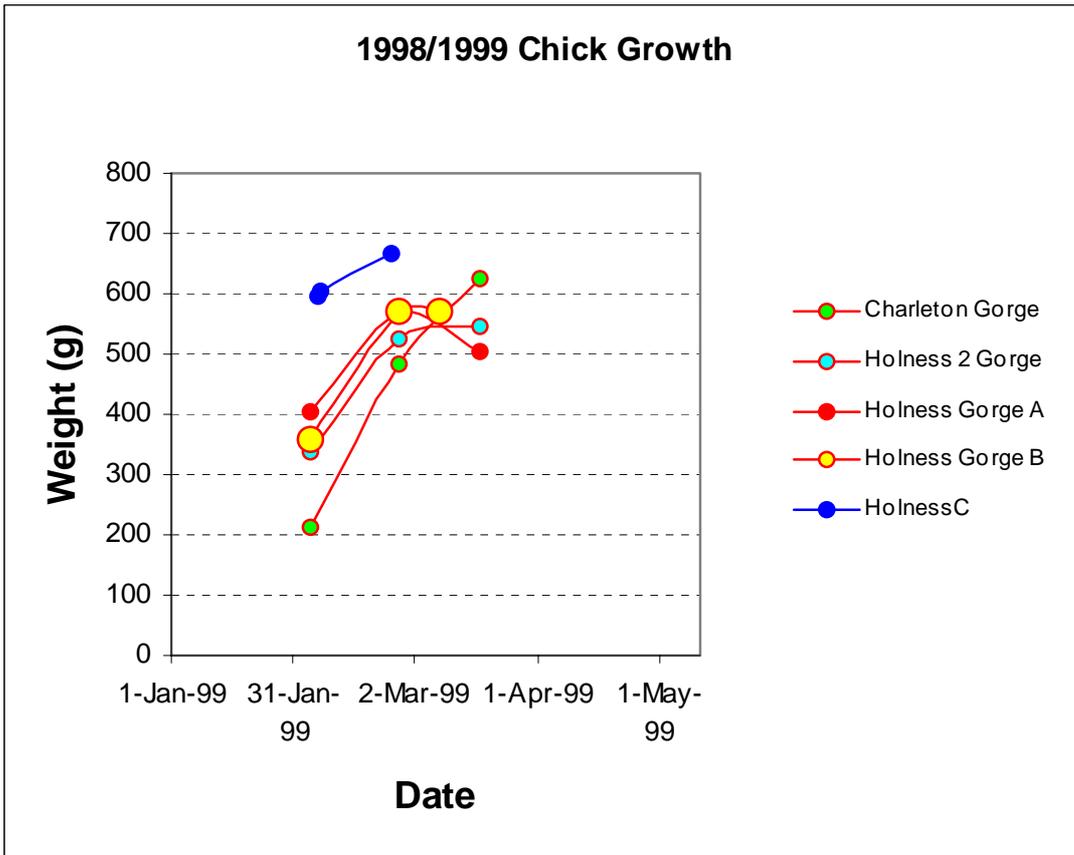
NAME	TYPE	TENURE	Installed	First use	Non-target Sp	Status ¹	Seasons Active	Notes
BACKPATCH	H	Private land		1998		UNK	1998/1999	
BALDHILL ROAD	H	Roadside, DCLEP		1996		D	1996/1997, 1999/2000, 2000/2001, 2001/2002, 2003/2004	Destroyed in 2005 fire
BLACK STUMP	H	Private land		2001		D	2001/2002, 2004/2005	Destroyed in 2005 fire
BLACK STUMP	H	Private land		2002		D	2002/2003	Destroyed in 2005 fire
EAST/BEESTING								
BROKEN LEG	H	Private land		2000		UNK	2000/2001	
BROOMBUSH	PP	Private land	Aug-05			OK	Never used (August2008)	LEPBRP
BURNT TREE	H	Private land		2003		D	2003/2004	Destroyed in 2005 fire
CORRAL	PP	Private land	Aug-05			OK	Never used (August2008)	LEPBRP
COWBONES	H	Private land		1996		D	1996/1997, 2000/2001, 2001/2002	Destroyed in 2005 fire
DAM	H	Private land		2003		D	2003/2004, 2004/2005	Destroyed in 2005 fire
DAMPOLY	PP	Private land	1999?	2003		R	2003/2004, 2004/2005, 2005/2006	Replaced by Dampoly2 to adjacent, more shaded tree.
DAMPOLY2	PP	Private land	Oct-06			OK	Never used (August2008)	

NAME	TYPE	TENURE	Installed	First use	Non-target Sp	Status	Seasons Active	Notes
DEAD	H	Private land		2005		OK	2005/2006	
DEEP	H	Private land		2003		D	2003/2004	Destroyed in 2005 fire
DEIRDRE	PP	Private land	Aug-05			OK	Never used (August2008)	LEPBRP
DROPIN	H	Private land		2002		UNK	2002/2003	
DRIVEWAY	PP	Private land	Aug-05			OK	Never used (August2008)	LEPBRP
DUCKSNEST	H	Private land		1997		UNK	1997/1998	
DUMP	H	Private land		2003		D	2003/2004	Destroyed in 2005 fire
EGYPT	H	Private land		2005		OK	2005/2006	
ELSON	H	Private land		2007		OK	2006/2007	
FALLEN	H	Private land		1997		UNK	1997/1998	
FLOODED	H	Private land		2002		UNK	2002/2003	
GALAH	PP	Private land	Aug-05		G 06/07	OK	Never used (August2008)	LEPBRP
GAMEAU	H	Private land		1999		UNK	1999/2000	
GRAEMES/CAMER A	H	Private land		1996		D	1996/1997, 1999/2000, 2000/2001	Destroyed in 2005 fire
GIANT2	PP	Private land	Aug-05			OK	Never used (August2008)	LEPBRP
GIANT	H	Private land		1999		UNK	1999/2000	
HAKEA	PP	Private land	Aug-05		G 07/08	OK	Never used (August2008)	LEPBRP
HEATHERS HILL	H	Private land		1999		UNK	1999/2000	
HILTON1	W	Private land	Nov-07			OK		Wooden box
HILTON2	W	Private land	Nov-07			OK		Wooden box
HOLNESS	H	Private land		1997		UNK	1997/1998	
HOLNESS C	H	Private land		1998		UNK	1998/1999	
HOPE	H	Private land		2005		OK	2005/2006	
HOPO	W	Private land	2005			OK	Never used (August2008)	Wooden box, Charlton Gully Sreamcare
HORIZONTAL	H	Private land		1999		UNK	1999/2000	
HYDE	PP	Private land	UNK	1999		D	1999/2000	Destroyed in 2004 wind damage.
HYDE2	PP	Private land	Oct-06	2006		OK	2006/2007	
HYDES HIL	H	Private land		1996		UNK	1996/1997, 2000/2001	
JANES	PP	Private land	Aug-05			OK	Never used (August2008)	LEPBRP
KENNEDY	W	Private land	Nov-07			OK	Never used (August2008)	Wooden box
KEYS	PP	Private land	Aug-05			OK	Never used (August2008)	LEPBRP

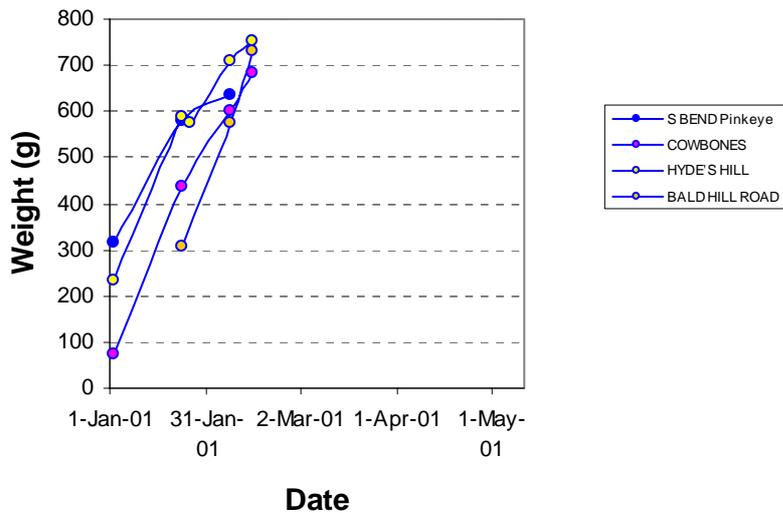
NAME	TYPE	TENURE	Installed	First use	Non-target Sp	Status	Seasons Active	Notes
KNOBBLES	H	Private land		2001		D	2001/2002	Destroyed in 2005 fire
LADDER	H	Private land		1998		UNK	1998/1999	
MANNEST	H	Private land		2000		UNK	2000/2001	
NEWEAS	H	Private land		2004		D	2004/2005	Destroyed in 2005 fire
NONAME	H	Private land		1998		UNK	1998/1999	
OVEN	H	Private land		1997		D	1997/1998, 2001/2002	Destroyed in 2005 fire
OVERHANG	H	Private land		2001		UNK	2001/2002	
PICKEL BARRELL	PP	Private land	2003	2003	WD	OK	2003/2004	Installed by landholder nest is old pickle barrel.
PINKEYE	H	Private land		2001		D	2001/2002	Destroyed in 2005 fire
PLACC 1	PP	ALT/PLACC	UNK			D	Never used (August2008)	Destroyed in 2005 fire
PLACC 2	PP	ALT/PLACC	UNK			D	Never used (August2008)	Destroyed in 2005 fire
PLACC 3	PP	ALT/PLACC	UNK			D	Never used (August2008)	Destroyed in 2005 fire
PLACC 4	PP	ALT/PLACC	UNK			D	Never used (August2008)	Destroyed in 2005 fire
PLACC 5	PP	ALT/PLACC	UNK			D	Never used (August2008)	Destroyed in 2005 fire
PLACC 6	PP	ALT/PLACC	UNK			D	Never used (August2008)	Destroyed in 2005 fire
PROTEAS	H	Private land		2001		UNK	2001/2002	
PROUDE SPOUT	H	Private land		2003		D	2003/2004, 2004/2005	Destroyed in 2005 fire
QUARRY	PP	Private land	Aug-05			OK	Never used (August2008)	LEPBRP
RESERVOIR	PP	Private land	Aug-05		CBP 07/08	OK	Never used (August2008)	LEPBRP
RIDGE	PP	Private land	Aug-05			OK	Never used (August2008)	LEPBRP
ROBS	PP	Private land	Aug-05			OK	Never used (August2008)	LEPBRP
S BEND	H	Private land		1996		D	1996/1997, 2000/2001, 2003/2004	Destroyed in 2005 fire
SARAHS	PP	Private land	Aug-05			OK	Never used (August2008)	LEPBRP
SHARON	PP	Private land	Aug-05		G 07/08	OK	Never used (August2008)	LEPBRP
STOVEPIPE/DOWN PIPE	H	Private land		2002		D	2002/2003, 2004/2005	Destroyed in 2005 fire
TALLPOLY	PP	Private land	UNK	2003		D	2003/2004	Destroyed in 2005 fire
TALL POLY2	PP	Private land	Aug-05			OK	Never used (August2008)	LEPBRP
TREVS	PP	Private land	Aug-05			OK	Never used (August2008)	LEPBRP
UNKNOWN	H	Private land		2000		UNK	2000/2001	
UNKNOWN2	H	Private land		2001		UNK	2001/2002, 2002/2003	
WEST POLY	PP	Private land	Aug-05			D	Never used as of Nov2005	Destroyed in 2005 wind damage

NAME	TYPE	TENURE	Installed	First use	Non-target Sp	Status	Seasons Active	Notes
WEST POLY2	PP	Private land	Aug-05	2006	G 07/08	OK	2006/2007	LEPBRP
WHILLAS	PP	Private land	Oct-06		G 07/08	OK	Never used as of Nov2005	
WOBBLY	H	Private land		2004		D	2004/2005	Destroyed in 2005 fire
WOODPILE	H	Private land		2001		UNK	2001/2002	

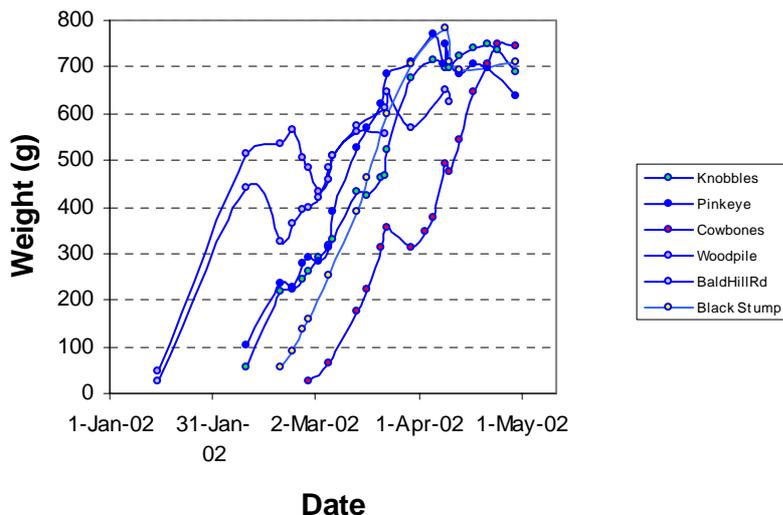
Appendix B: Eyre Peninsula Yellow-tailed Black-Cockatoo growth data, 1998 to 2004.



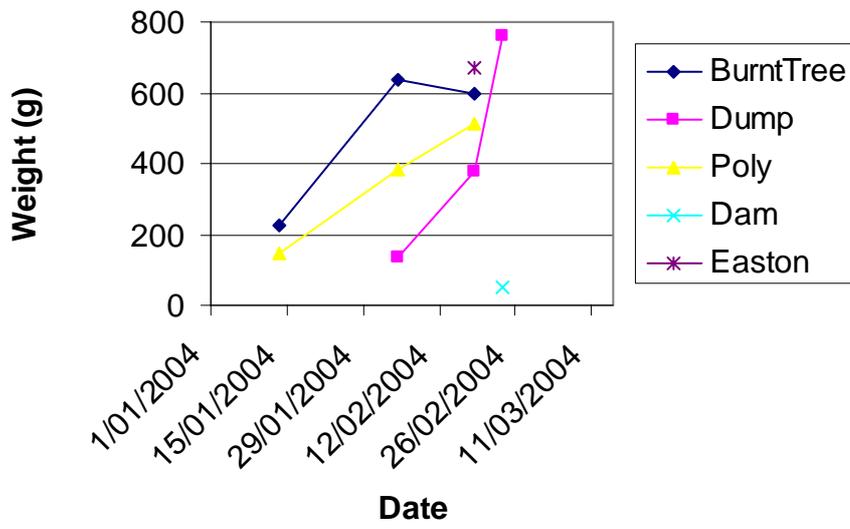
2000/2001 Chick Growth



2001/2002 Chick Growth



2003/2004 Chick Growth



Appendix C Photo point data

PHOTOPOINT NAME	EASTING	NORTHING	ESTABLISHED	YEARS MONITORED
COA1	572067	6178642	2005	-
COA2	572230	6178504	2005	-
COA3	572425	6178122	2005	-
COA4	571961	6177356	2005	-
EAS1	571414	6179332	2002	2005
EAS2	571674	6178909	2002	2005
GAM1	571401	6182885	2002	2005, 2006
GAM2	571363	6182927	2002	2005
HYDE1	570134	6177232	2002	2005, 2006
HYDE2	569243	6176086	2002	2005, 2006
MAN1	569374	6180282	2005	2006
PAC1	569172	6176400	2002	2005, 2006
PAC2	569174	6177354	2002	2005, 2006
THO1	566774	6179458	2001	2005
THO2	567886	6178048	2001	2005, 2006
THO3	567809	6178127	2001	2005, 2006
THO4	568643	6178919	2002	2005, 2006

Appendix D Sample EPYTBC field observation data sheet

The EPYTBC datasheet reflects the recommended dataset required to facilitate entry onto the Biological Database of South Australia (BDBSA) (DEH 2007b) and reflects data fields from the main observation database (EPYTBC PRIMARY DATABASE CURRENT.xls). Definitions for the fields appearing on the datasheet (over page) are given below.

ISCERTAIN	Indicates observer certainty about the ID of the record
EASTING	In UTM projection X axis coordinates - must be 6 digits
NORTHING	In UTM projection Y axis coordinates - must be 7 digits
RELIABNR	BDBSA geocode precision code ¹ related to a location method - use BDBSA_RELIABBR_LUT worksheet
LOCMETHODNR	BDBSA code for location method - use BDBSA_LOCMETH_LUT worksheet
SIGHTINGDATE	Must be recorded as dd-mmm-yyyy (06-JUN-2001)
DATEACCURACY	BDBSA describes a date as being accurate to the Day = D, Month = M (i.e. Day unknown but Month and Year certain), Decade = T and Century = C
OBSERVERNR1	The primary observer who made the decision about the identity of the record
LOCDESC	Observation location description or site name (especially if subject to repeat visits)
SIGHTINGCOMM	Comments relating to the sighting
METHODNR	Observation / capture method. Use BDBSA_METHODNR_LUT worksheet
OBSERVEDNR	Number of specimens observed/captured (unless recorded this is assumed to be “one”)

¹ Codes for each field are not presented here, but the relevant worksheets listing the codes are referred to and are on file at DEH

EYRE PENINSULA YELLOW-TAILED BLACK-COCKATOO RECOVERY PROJECT OBSERVATION DATASHEET. Datum: WGS84, ZONE53H

IS CERTAIN	EASTING	NORTHING	RELIAB	LOC METHOD	SIGHTING DATE	DATE ACCURACY	OBSERVER	METHOD	Activity	Number	Comments	Owner/Rd/ Section