RECOVERY PLAN FOR THE SOUTH AUSTRALIAN SUBSPECIES OF THE GLOSSY BLACK-COCKATOO (*Calyptorhynchus lathami halmaturinus*): 2005-2010

P.A. Mooney and L.P. Pedler

Glossy Black-Cockatoo Recovery Program
Department for Environment and Heritage
Kangaroo Island

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Helping Communities Helping Australia
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Further information and copies of this Recovery Plan are obtainable from:

Department for Environment and Heritage
Kangaroo Island
PO Box 39
Kingscote South Australia 5223

Plan prepared in compliance with the Australian Government's *Environment Protection and Biodiversity Conservation Act 1999.*

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Habitat Requirements and Limiting Factors:

The South Australian subspecies of the Glossy Black-Cockatoo requires high quality Drooping Sheoak (*Allocasuarina verticillata*) woodland for foraging, and large hollow bearing eucalypts for roosting and nesting habitat. Nest failure rate in unprotected nests is high, principally as a result of predation by Common Brushtail Possums (*Trichosurus vulpecula*).

Availability of feeding habitat and suitable nest hollows may limit abundance in the future. Fires that occur too frequently may also diminish the availability of habitat critical for survival.

Recovery Plan Objectives

The recent GBC Recovery Program Review (Burbidge and Raines 2003) emphasised the need for a longer term, fifty year perspective, when managing a slow-breeding species such as the Glossy Black-Cockatoo.

As a consequence, three long term objectives have been identified for recovery of the SA Glossy Black-Cockatoo:

(1) To ensure that a viable breeding population of the Glossy Black-Cockatoo persists in South Australia;

(2) To shift the status of the Glossy Black-Cockatoo from Endangered to Vulnerable within 25 years (ie. by 2030);

(3) To expand the current distribution of the Glossy Black-Cockatoo to include its former range on Fleurieu Peninsula.

For specific objectives, performance criteria and actions during the five year period of the Recovery Plan, see PART D.

PART A: SPECIES INFORMATION AND GENERAL REQUIREMENTS

1. Current Taxon Status of the SA Glossy Black-Cockatoo

The South Australian subspecies of the Glossy Black-Cockatoo, *Calyptorhynchus lathami halmaturinus,* has disappeared from the South Australian mainland and is currently restricted to Kangaroo Island (KI). It is listed as Endangered under the Australian Government's *Environment Protection and Biodiversity Conservation Act 1999*. The population comprises approximately 290-300 individuals, including around 200 mature individuals and was thought to be declining prior to implementation of threat mitigation practices in 1995.

At the time of writing of the previous Recovery Plan the subspecies was listed as Critically Endangered under IUCN Red List criteria (IUCN 1994). However, *The Action Plan for Australian Birds* (Garnett and Crowley, 2000) recommended downlisting to Endangered, category D, stating: "As a result of vigorous and effective conservation management, the population is at least stable and possibly increasing." The population in 2003 numbers less than 250 mature individuals and appears to be stable or increasing gradually. The Kangaroo Island population therefore still fits the criteria for Endangered.

The South Australian subspecies is also listed as Endangered under Schedule 7 of the SA *National Parks and Wildlife Act 1972*.

2. Description of species and subspecies

The Glossy Black-Cockatoo (*Calyptorhynchus lathami*) is the smallest member of the endemic Australian genus that includes most of the Black-Cockatoos. It is notable for its powerful bill, the scarlet red panels in its tail feathers and a highly specialised habitat and diet. On the basis of beak and wing morphology, Schodde *et al.* (1993) divided *C. lathami* into three subspecies: the core population in south-eastern Australia, *C. l. lathami*; an outlying population in central eastern Queensland, *C. l. erebus*; and the isolated population in South Australia, *C. l. halmaturinus*. This Recovery Plan addresses the management of the South Australian subspecies, which is distinguishable from the core subspecies by its small body and disproportionately large bill. It currently occurs only on Kangaroo Island.

3. Objects of the EPBC Act

3.1 Promoting a co-operative approach to the protection and management of the environment involving governments, the community, landholders and indigenous peoples.

Successful implementation of this recovery plan is dependent on the involvement of the local and wider Australian community, several non-government organisations, regional natural resource management bodies and the Kangaroo Island Council, in addition to the South Australian Department for Environment and Heritage (DEH) (see Part A, section 5).

The GBC Recovery Program has a long history of achievements brought about by working together with stakeholders, for example, collaboration with Greening Australia in habitat re-establishment projects and with Rotary Australia in the provision of artificial nesting hollows. This involvement of a range of agencies and individuals results in a co-operative approach to the management of the recovery of the SA Glossy Black-Cockatoo.

3.2 Assisting in the co-operative implementation of Australia's international environmental responsibilities

This species is not listed under any international agreement and the recovery plan does not affect Australia's international responsibility.

3.3 Recognising the role of indigenous people in the conservation and ecologically sustainable use of Australia's biodiversity

A draft of this recovery plan has been referred to the Aboriginal Partnerships Section of DEH, who will undertake consultation with the relevant indigenous communities. The consultation will determine the role and interests of indigenous communities with regard to the implementation of this plan.

4. International obligations

The actions identified in the recovery plan are consistent with Australia's obligations under the *Convention on Biological Diversity*, ratified by Australia in 1993, (EA 1998) and the *National Strategy for the Conservation of Australia's Biological Diversity* (ANZECC 2001). The plan does not impact on obligations made under the conventions on wetlands and migratory species.

5. Affected interests

A range of community and environmental groups, non-government organisations, Government agencies and departments and several business corporations are involved as stakeholders in the SA Glossy Black-Cockatoo Recovery Program (see Table 1).

GBC nesting and foraging habitat occurs on both public and private land on KI and Fleurieu Peninsula: Table 1 lists public and corporate landowners, private landowners are too numerous to list. Private owners of land that includes critical feeding and nesting habitat have been contacted, either in person, by phone or by letter during the course of the GBC Recovery Program and are generally supportive of the actions outlined in this Recovery Plan.

A number of landowners have taken out Heritage Agreements or Sanctuary Agreements that cover GBC habitat areas and the GBC Recovery Program continues to canvass landowners to undertake covenant protection agreements.

6. Roles and interests of indigenous people

A draft of this recovery plan has been referred to the Aboriginal Partnerships Section of DEH, who will undertake consultation with the relevant indigenous communities. The consultation will determine the role and interests of indigenous communities with regard to the implementation of this plan.

Table 1. Stakeholders in the Glossy Black-Cockatoo Recovery Program.

Kangaroo Island Community
Commercial tour operators on Kangaroo Island
Friends of Dudley Peninsula Parks and Wildlife
Friends of Parks, KI Western District
Glossy Black Rescue Fund
Kangaroo Island Beekeepers Association
Kangaroo Island Community Seed Bank
Kangaroo Island Council*
Kangaroo Island Eco-Action
Kangaroo Island GBC Recovery Program volunteers
Kangaroo Island landholders*
Kangaroo Island Natural Resources Management Regional Board
Local indigenous community
Middle River Landcare Group
Penneshaw School and Community Landcare Group
Tourism Kangaroo Island
Upper Cygnet River Landcare Group
Fleurieu Peninsula community
Adelaide and Mount Lofty Ranges Natural Resources Management Regional Board
District Council of Yankalilla*
Fleurieu Birdwatchers Inc
Fleurieu Peninsula landholders*
Southern Fleurieu Local Action Planning
State
Conservation Council of South Australia
Coast Protection Board*
Department for Environment and Heritage*
Department for Primary Industries and Resources South Australia
Department for Water, Land and Biodiversity Conservation
Friends of Parks South Australia
General public
Gerard Industries (Clipsal)
Green Corps
Greening Australia (SA)
Indigenous community
Natural Resource Management Council
Nature Foundation SA
Rotary Australia (SA)
South Australian Ornithological Association
Threatened Species Network (SA)
Trees For Life
University of Adelaide
Australian Geographic
Australian Growth Limited*
Birds Australia: Threatened Bird Network
The Department of the Environment and Heritage
General public
Great Southern Corporation*
Natural Heritage Trust
Tarong Energy Corporation
Treecorp Group*
WWF - Australia: Threatened Species Network

*Group directly owns and manages land supporting populations or habitat of the SA Glossy Black-Cockatoo.

7. Benefits to other species / ecological communities

Extensive clearance of native vegetation has occurred in South Australia, including clearance of the Drooping Sheoak / eucalypt communities that constitute GBC habitat. The area of GBC habitat on Kangaroo Island and Fleurieu Peninsula is far smaller than its extent prior to the arrival of Europeans (Crowley *et al.* 1998b).

Protection of remnant GBC habitat areas, in DEH reserves, and on private property through Heritage Agreements, Sanctuary Agreements and Land Management Agreements has significant benefits for the other flora and fauna species and ecological communities that occur within these areas.

Around 90 hectares of GBC feeding and nesting habitat have been re-established through incentives provided by the Glossy Black Rescue Fund, a component of the GBC Recovery Program initiated by the Kangaroo Island community in 1993.

As well as providing habitat for a range of other species, this revegetation effort raises community awareness of the plight of endangered species and of broader biodiversity issues. For example, publicity material emphasises the importance of planting species of local origin and a mixture of understorey and groundcover species, as well as trees when revegetating areas.

8. Social and Economic Impacts

This recovery plan will have minimal adverse social and economic impacts on the communities of Kangaroo Island and southern Fleurieu Peninsula. The recovery plan highlights the importance of preventing clearance of habitat critical for the survival of the Glossy Black-Cockatoo. While this might place economic constraints on some individuals, there will be an overall economic benefit to the Kangaroo Island community through improved natural resource management.

Amongst these benefits are the availability of funding to assist private landholders and community groups who wish to undertake habitat restoration works, promotion of co-operative community action and the development of community interest and skills in natural resource management.

PART B: DISTRIBUTION AND LOCATION

1. Population size

The annual population census on Kangaroo Island has been an essential index of GBC recovery. Between 1995 and 1998 the GBC population on Kangaroo Island apparently increased by over 25 per cent, from an estimated 195 individuals in 1995 to a population of 250-260 in 1998 (Pedler 1999) (Fig.1). This increase in population was attributed to a higher rate of recruitment due to prevention of possum predation on nests and erection of artificial nest hollows.

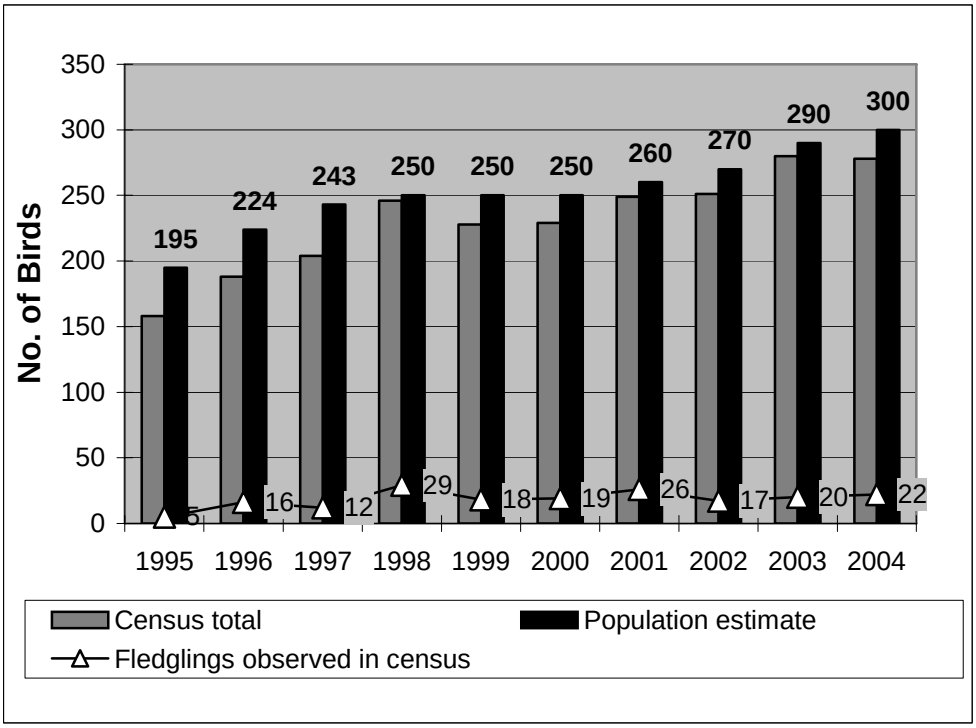

Figure 1. Annual KI population census results. Note that the 'Census total' is the minimum number of birds counted during the census, while the 'Population estimate' is an adjustment based on a comparison of totals from different localities.

Between 1998 and 2002 population growth slowed to 2% or less per annum suggesting that one or more other factors might be limiting growth (Burbidge and Raines 2003). However, recent census results appear to indicate a current population growth of around 4-5% (Fig. 1). A minimum of 278 individuals were counted during the most recent census held on Kangaroo Island in October 2004, resulting in a population estimate of 300-310 (Pedler and Mooney 2004).

The annual census data indicate that the population is recovering very gradually (Fig. 1). However, the Population Viability Analysis (PVA) conducted in 2002 suggests caution. Using GBC life history data collected from band observations on Kangaroo Island (L. Pedler unpubl. data), the program ALEX indicated that the population was declining at a rate of about 10% per year (Southgate 2002). Sensitivity analysis of the life history information suggests that the variation in adult mortality rate is critical to GBC population growth. The discrepancy between census and PVA estimates of population growth may well result from insufficient survivorship data for adult birds.

Burbidge and Raines (2003) suggest that the very low level of recruitment prior to threat management may have produced a population with a disproportionately large number of older birds. In this scenario, the relatively slow rate of population growth may be a result of these older

birds dying of old age, at a similar rate to the improved level of recruitment.

It is worth noting at this point that this very gradual rate of population increase emphasises the importance of long term on-going threat abatement to ensure the survival of the SA GBC.

2. Population sex and age structure

Joseph (1982) and later observers have noted an apparently male-biased sex ratio for the Glossy Black-Cockatoo on Kangaroo Island. This bias was recorded as 1.7 males per female at Lathami Conservation Park (J. Pepper unpubl. data). The ratio of adult males:adult females identified in the 1996-2003 population censuses averaged 1.5, although the sex ratio was not accurately defined since a significant proportion of birds were not observed closely enough to determine sex and age (GBC Recovery Program data, 1995-2004).

The reason for the bias is unknown but appears to be related to differential mortality since there is no apparent sex bias among nestlings (Garnett *et al.* 1999). Adult female GBCs have variable yellow markings on the head. Garnett *et al.* (1999) postulated that this conspicuous feature might result in disproportionately higher predation on females by raptors.

Prior to threat management, the population included a low proportion of young birds. In a survey in 1980, Joseph (1982) found only five juveniles among 115 birds, and in later surveys he noted three birds with immature plumage out of a combined total of 69 (Joseph 1987, 1988). A 1993 survey found no dependent juveniles, and 10 birds with sub-adult plumage out of 136 (Pepper 1994).

Annual population censuses conducted since 1995 have provided demographic data regarding age and sex structure. The population census in 1995 found 5 dependent juveniles and about 8 immature birds (Pedler 1995). The low number of juveniles was a reflection of a low breeding success: in 1995 only 3 of the 15 monitored nests produced young. In the 1996 census, following protection of all known nests from Common Brushtail Possums, 16 dependent juveniles were observed (Garnett *et al.* 1996). On average, 22 dependent juveniles (fledglings) were identified in the 1998-2004 censuses (Fig. 1).

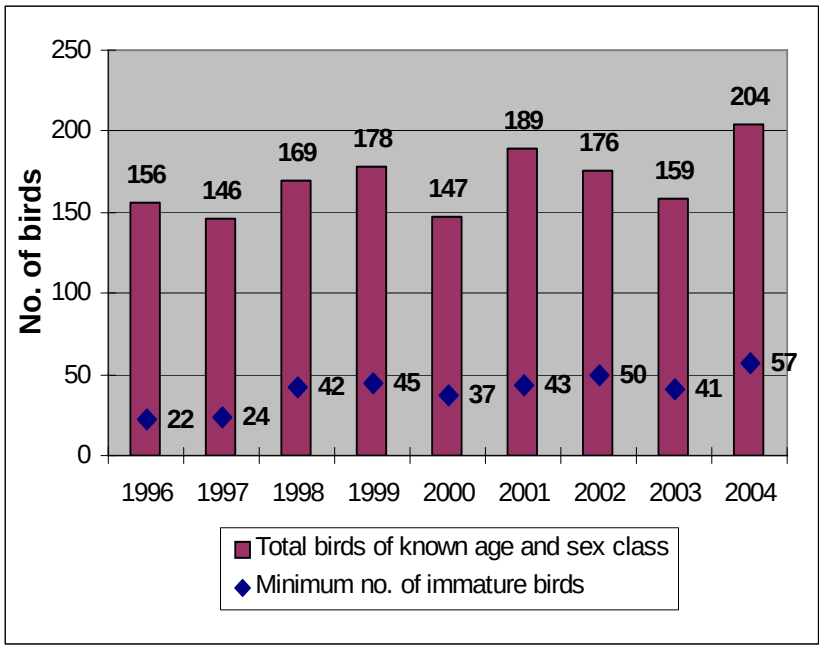

Figure 2. Number of birds of known age and sex class less than three years old, as recorded in the annual GBC census.

Since 1998, at least 20% of the birds of known age and sex class identified in the annual population censuses have been less than three years old (Fig. 2).

3. Distribution

3.1 Historical distribution

Until climatic changes during the most recent glacial epoch 12-25,000 years ago, the South Australian subspecies of Glossy Black-Cockatoo probably occurred across south-east South Australia and western Victoria (Schodde *et al*. 1993). At the time of European settlement it was confined to Kangaroo Island, the Fleurieu Peninsula, the southern Mount Lofty Ranges and possibly Eyre Peninsula (for which evidence of its occurrence is anecdotal) (Crowley *et al.* 1997).

Joseph (1989) summarises reported sightings of the SA GBC in the southern Mount Lofty Ranges. For example, Mr. Gordon Lord reported to Mr. Shane Parker that he had observed GBCs in the 1930s flying across Backstairs Passage from the Southern Fleurieu coast to Kangaroo Island. He was of the opinion that some of the birds flew to KI for the winter, leading Joseph (*op. cit.*) to suggest that part of the mainland population regularly flew to KI to nest.

The subspecies is currently restricted to Kangaroo Island, with the last confirmed record on Fleurieu Peninsula in 1977 (Joseph 1989). Reported sightings of GBCs on southern Fleurieu Peninsula in December 1996 and July 1999, of three and five birds respectively, could not be confirmed (L. Pedler pers. comm.). Searches for 'chewings' following several more recent sightings have proved fruitless, although a sighting of 2 birds near Spring Mount Conservation Park in January 2002 seems likely to have been this species.

3.2 Kangaroo Island population

The South Australian subspecies of the Glossy Black-Cockatoo may be considered to be present throughout the area on Kangaroo Island occupied by Drooping Sheoak feeding habitat and mapped nest locations (see Section 4.4.3). Note that the spatial data for GBC nest locations is to be regarded as highly confidential.

The remnant population on Kangaroo Island occurs mainly along the north coast and hinterland, centred around the distribution of food resources. Breeding currently occurs on the western two-thirds of the Island, with the population loosely segregated into six flocks, with some movement between them (Fig. 3).

In recent years, fewer birds have visited Dudley Peninsula in the Spring-Summer post-breeding period than the groups of twenty or so seen in the early to mid 1990s.

GBCs have not returned to the West Bay region (Fig. 3) to feed or breed since 187 ha of Drooping Sheoak was burnt in a 1991 wildfire. Large areas of feeding habitat in the Wisanger area remain virtually unused by the birds.

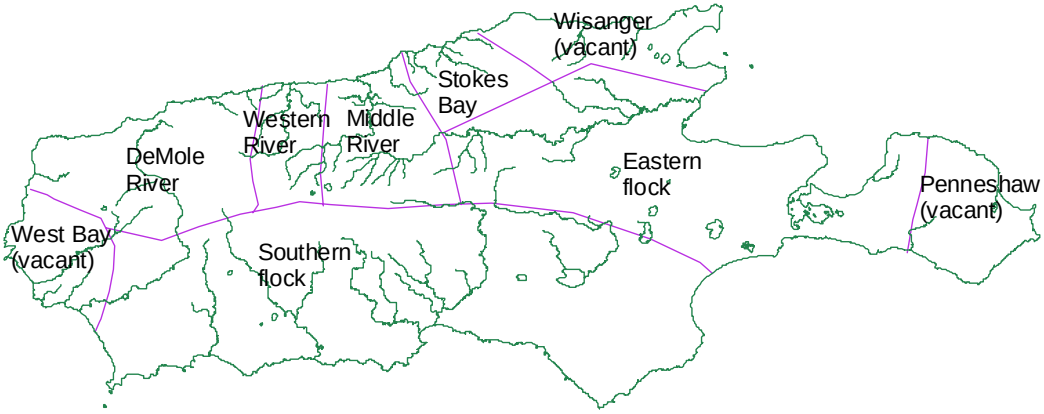

Figure 3. Approximate boundaries between GBC flocks on Kangaroo Island

4. Habitat

4.1 Feeding habitat

The diet of Glossy Black-Cockatoos is highly specialised and consists almost entirely of sheoak seeds. The South Australian subspecies feeds primarily on Drooping Sheoak, *Allocasuarina verticillata* (Joseph 1982). This sheoak species is widely distributed across Kangaroo Island, being frequently dominant in tall woodland, or sub-dominant below a eucalypt canopy (Ball and Carruthers 1998). Crowley *et al.* (1998a) undertook more detailed mapping and also established geological and slope profiles of existing stands in order to identify the likely pre-European extent of *A. verticillata* habitat, highlighting potential areas for revegetation.

Crowley *et al.* (1998a) estimate that 4766 ha of Drooping Sheoak remains on Kangaroo Island, approximately three quarters of the original area. This represents 1.1% of the Island's landscape and 2.3% of the existing native vegetation (Appendix 1). Over 90% of this Drooping Sheoak habitat occurs on pre-Quaternary settings, principally Cambrian sandstone.

Feeding habitat carrying capacity has been estimated at 1 adult per 3 ha. (Crowley *et al.* 1997), based on a cone density of 835,000 cones/ha. (Pepper 1997), and assuming that the birds feed on around 10% of available trees. Subsequent research has estimated average cone density at 334,000 cones/ha (Chapman and Paton 2002), suggesting that the existing 4766 ha of Drooping Sheoak may support less than the 1600 birds estimated by Crowley *et al. op. cit.*

Further analysis indicates that each of the six flocks (Fig. 3) have access to the following areas of existing sheoak habitat, (S. Carruthers pers. comm.):

De Mole River	904 ha
Western River	423 ha
Middle River	422 ha
Stokes Bay	508 ha
Eastern flock	1010 ha
Southern flock	318 ha
Dudley Peninsula	400 ha (visited by small groups of non-breeding GBCs)

GBC nests were found to have an average of 740 ha of feeding habitat within a radius of 12 km (Crowley *et al.* 1998b). Nest sites with less than 400 ha of Drooping Sheoak within this radius were considered to be at risk. While the eastern flock has access to more than 1000 ha, nesting areas at Cygnet River and American River have access to much less than 400 ha of Drooping Sheoak. On this basis, Crowley *et al.* (1998b) established priority areas for re-establishment of

feeding habitat. Mapping had identified 9032 ha of cleared land on KI with the potential for revegetation with Drooping Sheoak (Crowley *et al.* 1998a).

Glossy Black-Cockatoos also take the seed of Slaty Sheoak (*Allocasuarina muelleriana*) (Pepper 1993), usually close to frequented stands of *Allocasuarina verticillata* (L. Pedler pers. comm.). This species may provide an important resource when the principal food is at low abundance, on a temporary seasonal basis, or at times when Drooping Sheoak has been heavily impacted by wildfire. As the use of this species as feeding habitat is apparently not extensive, detailed mapping has not been undertaken.

4.2 Nesting habitat

The large old eucalypts that constitute GBC nesting habitat occur mainly along creeks and river systems across Kangaroo Island. Sugar Gum (*Eucalyptus cladocalyx*), South Australian Blue Gum (*E. leucoxylon*) and Manna Gum (*E. viminalis* ssp. *cygnetensis*) are known to produce hollows suitable for GBC nest sites (Garnett *et al.* 1999). Most current natural nests (>85%) occur in Sugar Gums, and Sugar Gum stands also provide most of the roosting sites.

Trees that develop suitable GBC nest hollows are thought to be at least 100 years old and possibly much older. Around 15% of the 100 nest trees located to date are dead trees.

GBCs are known to fly up to 14 km between feeding and nesting areas, without adversely affecting breeding success (L. Pedler, unpubl. data), however, most nests are within 1 km of Drooping Sheoak and 200 m of permanent water (Crowley *et al.* 1997).

Vegetation communities containing suitable nesting trees ('suitable nesting habitat') cover around 33,000 ha or 7.6% of Kangaroo Island (Crowley *et al.* 1998a, based on mapping by Ball and Carruthers (1998)), (See map, Appendix 1). Communities dominated by Sugar Gum predominate (32,242 ha). Not all habitat within these communities is likely to be used by the GBC, as nests tend to be in patches with larger trees close to sheoak. For example, the vast majority of the 14,759 ha that lies within Flinders Chase National Park and Wilderness Protection Area has apparently never been used, presumably because there are only isolated patches of Drooping Sheoak in the area.

GBCs do not currently breed east of American River, although Crowley *et al.* (1998b) refer to anecdotal reports of nesting on Dudley Peninsula in the 1970s. Suitable nesting hollows are scarce on Dudley Peninsula and to date the birds have not used the artificial hollows that have been provided at several sites.

Increased understanding of the tree and hollow parameters that define successful GBC nest sites might help define priority areas for protection of GBC nesting habitat, as recommended in the GBC Five Year Review (Burbidge and Raines 2003).

4.3 Habitat on southern Fleurieu Peninsula

The Glossy Black-Cockatoo's disappearance from mainland South Australia has been largely attributed to habitat loss (Joseph 1982). However, the predominance of Drooping Sheoak on steep non-arable slopes means that some remnants of reasonable size remain. At least 147 ha of remnant potential GBC feeding habitat has been identified on southern Fleurieu Peninsula (Andrews 1995). This is not sufficient to secure a nesting area (Crowley *et al.* 1998b) but could be used by non-breeding birds.

Potential GBC habitat on southern Fleurieu Peninsula has been broadly mapped using existing DEH floristic vegetation mapping. This includes vegetation associations containing primary feeding habitat, *Allocasuarina verticillata*, secondary feeding habitat, *Allocasuarina muelleriana*, and associations containing potential nesting habitat (*Eucalyptus leucoxylon, E. fasciculosa, E. camaldulensis, E. baxteri* and *E. obliqua).* Potential nest tree species are based on nest sites used

by Yellow-tailed Black-Cockatoos on Fleurieu Peninsula (J. Van Weenen, pers. comm.).

Drooping Sheoak sampled on southern Fleurieu Peninsula had generally poor to marginal food quality, although sufficient high quality feeding habitat exists to support 50 non-breeding birds (Crowley *et al.* 1998b). GBCs are known to feed occasionally on Slaty Sheoak (*Allocasuarina muelleriana*) on Kangaroo Island and this species may provide a potential food resource for the GBC on Fleurieu Peninsula.

The most suitable nesting sites are likely to be those currently used by Yellow-tailed Black-Cockatoos, notably those in Deep Creek Conservation Park, about 12 km east of the closest landfall to Kangaroo Island (Andrews 1995). In the next five years, it is unlikely that GBCs will make more than irregular forays in small groups to forage on the mainland. If a feeding population establishes itself at some time in the future, then it may be necessary to manage potential nesting areas closely (Crowley *et al.* 1998b).

4.4 Habitat that is critical to survival

4.4.1 Feeding Habitat

All the mapped *Allocasuarina verticillata* habitat on Kangaroo Island may be regarded as critical to the survival of the SA Glossy Black-Cockatoo. While the area mapped is more than that required by the current population (Crowley *et al.* 1997), significant areas could be lost in wildfire. In addition, as the population continues to expand, larger areas of habitat will be required. It should be noted that GBCs appear to have preferences for certain trees or patches of trees, and so a percentage only of Drooping Sheoak trees in the area mapped will be utilised by the birds (See discussion in Part C, Section 1.1).

4.4.2 Nesting habitat

As stated in Section 4.2, the GIS nesting habitat layer needs some refining before habitat critical to the GBC's survival can be determined. At this stage, it is proposed that critical nesting habitat be defined by a buffer of one kilometre in 'suitable nesting habitat' surrounding existing nest sites. However, it is likely that future natural nest sites used by the GBC may lie outside this buffered area and so, until further refinement occurs, the remainder of the mapped 'suitable nesting habitat' should be regarded as potentially critical habitat.

4.4.3 Mapping of habitat critical to survival

Six GIS layers have been provided:

a) Drooping Sheoak feeding habitat – Kangaroo Island
b) 'Suitable nesting habitat – Kangaroo Island
c) Nest locations – Kangaroo Island (confidential)
d) Critical nesting habitat – Kangaroo Island
e) 'Suitable feeding habitat' – Fleurieu Peninsula
f) 'Suitable nesting habitat' – Fleurieu Peninsula

As stated elsewhere, the 'suitable nesting habitat' layers for both Kangaroo Island and Fleurieu Peninsula are based on vegetation associations containing suitable nest tree species and only some of this area is likely to contain suitable nest sites.

4.5 Land manager consultation

While 45% of 'suitable nesting habitat' lies within DEH reserves, much of this area is not currently used by Glossy Black-Cockatoos. Around 31% of *Allocasuarina verticillata* feeding habitat lies with DEH reserves. A further 6% of feeding habitat and 8% of nesting habitat is protected in Heritage Agreements.

Therefore, more than 60% of feeding habitat lies on private land, not covered by Heritage Agreement, although a proportion of this is known to be fenced from stock (Glossy Black Rescue

Fund, unpubl. records). Around half of 'suitable nesting habitat' area is also privately owned. More significantly, 87 out of around 130 natural and artificial nest sites known to have been used by Glossy Black-Cockatoos are on private land. This has implications for more than 30 landholders, including three forestry corporations.

The GBC Recovery Program has on-going liaison with Kangaroo Island landholders, with around 100 receiving the bi-annual 'Chewings' newsletter. The program also has regular dealings with landholders who manage land containing GBC nest sites and to date there have been no significant issues regarding access to or protection of these nest sites.

In May 2003, a letter was mailed out to around 100 local residents and 160 off-Island landowners in the American River area, advising them of the critical importance of GBC habitat in this area. This followed concern about on-going clearance of Drooping Sheoak in residential subdivisions previously created at American River. GBC Recovery Program officers also have occasional contact with landowners on Kangaroo Island and Fleurieu Peninsula regarding conservation and restoration of GBC habitat. Incentive funding has been provided for on-ground works through the Glossy Black Rescue Fund (GBRF) since 1995.

There is on-going liaison between the GBC Recovery Program and the Kangaroo Island Council regarding GBC habitat protection. Some GBC habitat, including nest sites, is located on roadsides or in other reserves managed by Council. The recovery program also provides advice to Council regarding development applications that may impact on GBC habitat (see also Section 2.3.3).

PART C: THREATS

1. Background - Biology and ecology

1.1 Diet and foraging ecology

The principal food source for the Glossy Black-Cockatoo on Kangaroo Island are the kernels of Drooping Sheoak, *Allocasuarina verticillata*, although Slaty Oak, *A. muelleriana,* is also taken at times. The cockatoos sometimes chew *Eucalyptus* fruits and sheoak branches, but this does not seem to be directed towards feeding and is associated with social and maintenance behaviours, such as preening (Pepper 1996, T. Chapman pers. comm.).

GBCs feed on the red-brown cones that have been produced within the previous year (Joseph 1982; Clout, 1989), rather than the older grey cones which have been found to have lower food value. Breeding birds appear to harvest better quality cones, feed on more cones per day and spend more time feeding than non-breeding birds (Crowley and Garnett, 2001; Chapman and Paton, 2002). Chapman and Paton (2002) reported that breeding males spent a little over 50% of the day time foraging, compared to around 38% for non-breeding males. Since even breeding males spent nearly 40% of the day perching, they concluded that food supply is not limiting the ability of the cockatoos to harvest sufficient food to survive and reproduce. This is supported by their finding that only 6% of branches and 20% of female plants had been foraged on by GBCs over periods longer than a year.

Groups of GBCs feed in the same area for a period of days or weeks before shifting to a new foraging location. They leave a tell-tale carpet of chewed fragments and cone ends (known as 'chewings') under feeding trees. Over time, these initially pale coloured fragments weather to shades of orange and pale brown. The birds appear to show a preference for specific trees which they return to repeatedly while neglecting nearby trees. There are a number of theories to explain the selection of foraging trees by GBCs.

Clout (1989) concluded that GBCs (eastern subspecies, *C. l. lathami*) at his study site in New South Wales chose trees with larger cone crops and concentrated their foraging in trees bearing cones with a high seed-to-cone mass ratio. Early studies of the South Australian subspecies on Kangaroo Island indicated that the preferred trees are larger, with larger seed containing more lipid and protein (Pepper *et al.* 2000).

While GBCs are known to regularly forage in Drooping Sheoak trees of varying size and density, research by Tamra Chapman suggests that the cockatoos may forage more commonly in larger trees with greater girth. Chapman found that there was otherwise little difference between foraged trees and neighbouring trees although GBCs apparently return to forage in some plots in preference to others (Chapman and Paton 2002). Preferred feeding locations within trees appear to be correlated with the average number of red-brown cones per sheoak branch.

Crowley and Garnett (2001) suggest that the cockatoos select trees initially on visual cues, such as the presence of chewings under the tree and number of cones per tree. Specific feeding trees may then be selected to optimise seed kernel intake, by 'taking several bites and processing a few seeds' to assess seed fill and kernel ratio.

1.2 Reproductive biology

The breeding biology of the GBC on Kangaroo Island has been described in some detail (Garnett *et al.* 1999) and the following summary is based on that paper and personal observations by Lynn Pedler. GBCs are closely paired year round, the pairs appearing to be permanent or semi-permanent. They nest from late summer to spring, with records of egg laying from January through to July.

Nests are in tree hollows, usually high in live eucalypts such as Sugar Gums or South Australian

Blue Gums, and are frequently clustered in the landscape. Nest hollow competition is known to occur from the Common Brushtail Possum, feral honeybees (*Apis mellifera*) and native bird species that have increased in abundance on Kangaroo Island, including the Galah (*Cacatua roseicapilla*), Little Corella (*C. sanguinea*), Yellow-tailed Black-Cockatoo (*Calyptorhynchus funereus*) and Barn Owl (*Tyto alba*).

Nesting pairs show little territoriality, and two to three concurrent nests have been observed in the same tree (Garnett *et al.* 1999). Many nest hollows are used repeatedly, both within and between years, though only sometimes by the same individuals. Nest preparation is minimal, although the female may line the hollow floor with wood chips chewed from inside the hollow.

The female lays a single egg clutch, and performs all incubation and brooding. The egg hatches after approximately 30 days. The male regurgitates food for the nesting female, who in turn feeds the nestling. If the egg or small young is lost some females replace the egg within 21 days, although re-laying appears to be less likely if the nest has been predated by the Common Brushtail Possum. Up to three clutches per season have been laid by some females.

The nestling fledges about 90 days after hatching, after which it is fed by both parents. The growth rate of GBC chicks is slower than for any other cockatoo species studied.

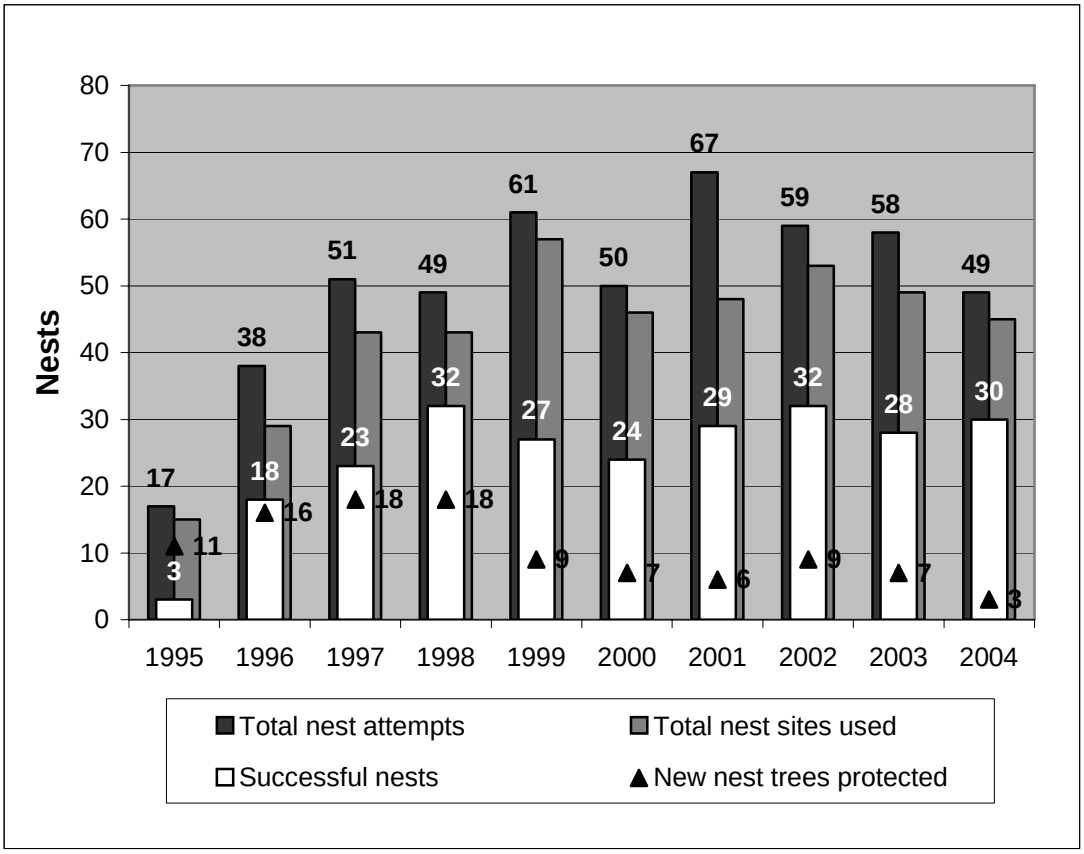

Figure 4. Glossy Black-Cockatoo nesting success on Kangaroo Island 1995-2004.

The proportion of successful nests / per nest attempt has increased from 17% (3 nests) in 1995, prior to protection of nests from possums, to an average of 51% (28 nests) from 1997-2004 (Fig. 4). Note that not all nestlings are identified during the annual census. Some may not have survived while others are not identified in the flocks observed. As a result, the numbers of dependant juveniles (fledglings) identified in the censuses (Figure 1) is lower than the number of nestlings for respective years graphed in Figure 4.

At present about 48 active GBC nests are located each breeding season (1997-2004 average).

Each year the cockatoos select a mixture of previously used and new (unprotected) natural nest hollows. Crowley *et al.* (1997) found 43% of natural hollows were used in successive years; 58% of hollows used in 2001 were used again in 2002 (GBC Recovery Program data, 1995-2004).

Over 80 artificial hollows have been erected in known and potential GBC nesting areas on Kangaroo Island, mostly constructed of PVC plumbing pipe. Most have been erected where there are sparse natural nest sites and to date 41 have been used by nesting Glossy Black-Cockatoos. They are regularly used by the cockatoos in some areas but rarely if ever used in others. Between 1996 and 1999, 18-22% of successful nests were recorded in artificial hollows. Since 2000, this percentage has risen to 25-35%. Natural and artificial hollows appear to have a similar success rate of around 50% (GBC Recovery Program data, 1996-2004).

1.3 Life history

The period of juvenile dependency usually lasts at least until the onset of the following breeding season, though some pairs do not breed in the subsequent season and may continue to feed their young for up to a year. Some juveniles, particularly females, are fed by unpaired males after leaving their parents. During the period of dependency the juvenile accompanies its parents at all times, including roosting in physical contact. Parents preen their dependent young and feed it both by regurgitation and by sharing partially eaten sheoak cones. Juveniles develop foraging skills slowly, and for some months are noticeably slow and awkward at handling cones.

Juvenile females progressively moult into adult plumage over at least the first three years (L. Pedler pers. obs.). Males may begin to lose their juvenile tail bars as early as the second moult, and most have full adult plumage (i.e. unbarred tails) by age four years, although some barring has been observed up until the seventh year in captive birds (Courtney 1986). Up to 32 nestlings per season, from 1995-2003, have been banded with numbered stainless steel bands (size 210 Australian Bird and Bat Banding Scheme). Band numbers can be read in the field, by practised observers, using a tripod mounted telescope. From 1997 to 2002, wire or colour powder coated stainless steel bands were also placed on the right leg, to facilitate identification of age cohorts.

On Kangaroo Island, one two year old female has successfully raised a nestling but most females begin breeding at three or more years of age. The population's sex bias results in the frequent pairing of younger (banded) females with older (unbanded) previously unpaired males. The first recorded nesting attempt of a banded male occurred in 2003. This nesting attempt by a five year old male, paired with a three year old female, was unsuccessful due to possum predation of the egg (Pedler 2003b). Observations of captive birds indicate that male GBCs can reach sexual maturity at two years of age (Peter Chapman pers. comm.)

Little information is available on mortality rates of free-flying birds but the remains of fifteen dead cockatoos have been found on Kangaroo Island between 1995 and 2002, at least three of which appeared to have been eaten by avian predators (L. Pedler unpubl. data). Predation by Wedge-tailed Eagles (*Aquila audax*) was the primary cause of mortality in Short-billed Black-Cockatoos (*Calyptorhynchus latirostris*) studied in Western Australia (Saunders 1982), and the behaviour of GBCs suggests that Wedge-tailed Eagles, which are common on Kangaroo Island, prey on them as well. One GBC carcass found on Kangaroo Island showed signs typical of predation by a Peregrine Falcon (*Falco peregrinus*) (T. Dennis unpubl. data) and another two may have been killed by Brown Goshawks (*Accipiter fasciatus*).

Both the preliminary Population Viability Analysis (Southgate 2002) and Five Year Review (Burbidge and Raines 2003) have highlighted the importance of on-going collection of survivorship data. Of the 206 Glossy Black-Cockatoo nestlings banded between 1995 and 2003, 93 have been resighted (L. Pedler unpubl. data). Observations of banded birds from 1996 to 2001 indicates that around 50% of fledged birds survive to one year of age (Southgate 2002). Average annual survivorship for one to three year olds ranged between 77% and 83%, increasing to 85% for GBCs older than three years.

The species' mean and maximum life spans are unknown but longevity is likely to exceed 15 years and may extend to 50 years (Hill, 1950, in Pepper, 1996). The reason for the lower survivorship of adult females, referred to in Part B, Section 2, is not clear.

1.4 Movements of marked birds

Glossy Black-Cockatoos may fly considerable distances within a 'flock' region, as exemplified by birds in the 'eastern flock' that regularly move between Parndana and American River, a distance of around 40 km. Some of the breeding birds in this region make daily flights of 25-30 km (round trip) between feeding and nesting areas.

Observations of banded birds indicate that most individuals remain within their natal flocks, but there is some movement between flocks (L. Pedler pers. comm.). Southgate (2002) reports that 27% of individuals were never observed away from the general area where they had fledged and this included some birds older than four years of age. Of those that moved, most remained in the 'flock region' (Fig. 3), with only 23% observed moving into another region. Individuals older than one year moved distances averaging 44 km and up to 78 km.

2. Threats to survival

2.1 Causes of past decline

The population size and range of the South Australian subspecies have contracted substantially. (See Part B, Section 3.1). GBCs were reported as being plentiful in the ranges south of Adelaide in the mid to late 1800s (Mathews 1916). They became increasingly scarce on Fleurieu Peninsula up to the last confirmed sighting on the mainland in 1977 (Joseph 1989). There is insufficient data to determine the degree of GBC population decline on Kangaroo Island prior to implementation of threat management actions in 1995.

The main reason for the historical decline of the cockatoo on the mainland is thought to be habitat loss. Land clearance for agriculture has left little sheoak woodland in mainland South Australia and the trees were also harvested for firewood and ornamental use (Cleland and Sims 1968). Frequent fires may also have played a role in habitat destruction.

Grazing by rabbits (Cooke 1987), sheep, cattle and goats can prevent sheoak regeneration, as can grazing by native animals. (Note that no rabbits exist on Kangaroo Island). The Tammar Wallaby, Common Brushtail Possum and Western Grey Kangaroo occur in high numbers over much of KI. The Tammar Wallaby no longer occurs on the South Australian mainland and kangaroos are the major cause of wildlife grazing damage on Fleurieu Peninsula. In addition, clearance of large hollow-bearing trees has reduced breeding habitat availability, both in absolute terms and because there is increasing pressure on breeding birds from predators and competitors for the remaining hollows.

The South Australian Glossy Black-Cockatoo continues to be vulnerable to decline because its small numbers and limited range leave it at risk from catastrophes such as fire and disease. Actions intended to investigate or relieve each threat are outlined in PART D.

2.2 Threats to breeding success

All available evidence points to a low recruitment rate on Kangaroo Island prior to implementation of management actions (Part B, Section 1.2). The principal cause was found to be the high rate of nest predation by Common Brushtail Possums (Garnett *et al.* 1999). Known causes of egg and nestling loss since 1998 are recorded in Table 2.

2.2.1 Nest predation

The principal predator of GBC nest contents appears to be the Common Brushtail Possum which eats both eggs and young (Garnett *et al.* 1999). Garnett *et al. (*1999) note that possums 'occur at

extremely high densities on Kangaroo Island, particularly in partially cleared agricultural land where densities of 10 per kilometre have been recorded on vehicle based spotlighting transects... it is likely that clearance of the native vegetation for farming has been to the advantage of the possums, and consequently to the disadvantage of the Glossy Black-Cockatoo'. The species seems to benefit from the lack of predators, eg foxes, and from partial clearance of natural vegetation, being able to shelter in habitat remnants and forage on improved pastures.

Garnett *et al.* (1999) report an increase in success rate from 23% for unprotected nests to 42% for nests protected from possum access with iron tree collars. GBC Recovery Program data for 1996 to 2004 indicates an average nest success in protected trees of 51%.

Table 2. Known causes of Glossy Black-Cockatoo nest failure on Kangaroo Island 1998-2003

	1998	1999	2000	2001	2002	2003
Egg loss						
Failed to hatch	5	3	6	10	7	4
Predation/competition						
Possum		2				3
Galah						1
Sulphur-cr'd Cockatoo		4	2			
Glossy Black-Cockatoo			1			1
Barn Owl				1	1	
Broken/dented egg	7	4	7	5	3	6
Misadventure						
Fire						
Nest flooding	1		2	2	1	
Hollow collapsed		1				
Parental behaviour						
Unknown (empty)	3	12	8	13	10	12
TOTAL	**16**	**26**	**26**	**31**	**22**	**27**
Nestling death						
Predation/outside agent						
Possum						1
Little Corella						
Feral bees		1				
Unknown predator		1				
Misadventure						
Nest flooding	1	2				
Nest collapse						
Parental behaviour		1				
Unknown		1		4	5	1
TOTAL	**1**	**6**	**0**	**4**	**5**	**2**

Each year the cockatoos select a mixture of previously used and new (unprotected) natural nest hollows. Seven out of 49 nest sites used in 2003 were in trees that had no protective collars (Fig. 5). Around the same number of corrugated iron tree collars require repair each year. This indicates that each year about 14 nest hollows would be vulnerable to predation without on-going management and suggests that the proportion of protected nests would gradually decline if nest searches and associated management ceased.

It is notable that possums caused the failure of at least four nests in 2003, including the death of a feathered nestling (Table 2) (Pedler 2003b). There is an obvious need for on-going vigilance in regard to tree collar maintenance and pruning of overlapping canopies as nest trees grow. Galahs are widespread on Kangaroo Island, as they are through many parts of Australia, as a result of

changes to the landscape wrought by European agriculture. They were first recorded on Kangaroo Island in 1913 and had become abundant by the 1960s (Baxter 1995).

Galahs have been recorded removing eggs from GBC nests (Garnett *et al.* 1999), and are suspected to be responsible for the failure of a number of other nests from 1998 to 2003 (L. Pedler pers. comm.). Interference from Galahs may well have caused a significant proportion of the broken eggs and empty nests recorded in Table 2, although some of these may already have been abandoned or had infertile eggs.

Similarly, the population of Little Corellas has increased as the area of farmland utilised for grain cropping has expanded, providing improved food resources for this species, that were first recorded breeding on Kangaroo Island in 1991 (Garnett *et al.* 2000). Numbers of both Little Corellas and Galahs on Kangaroo Island may still be increasing, since major land clearance and cropping changes have occurred in the last fifty years. The summer/autumn population of Little Corellas on Kangaroo Island was recently estimated at around 700-800 birds (Masters 2002).

Breeding pairs of Little Corellas search for nest hollows in winter, towards the end of the Glossy Black-Cockatoo breeding season and may kill chicks they find in occupation. Two GBC nestlings were lost as a result of Corella interference in 1997 (Garnett *et al.* 1999). Garnett *et al.* (1999) state that 'management to check the growth of both Galah and Little Corella populations is therefore desirable in Glossy Black-Cockatoo nesting areas'.

Culling of Little Corellas at nest sites (1998-2004: 486 birds shot) has clearly had a positive impact, since the corella population has increased during this period but no GBC nestling deaths have been recorded. However, attempts by the Kangaroo Island Pest Bird Management Task Group to reduce numbers through trapping have had only limited success to date (Masters 2002).

Sulphur-crested Cockatoos caused the failure of at least six nest attempts during 1999-2000 (see Table 2) and may have been responsible for several nest failures since then (L. Pedler pers, comm.). Where the problem is caused by one or two birds that are probably cage escapees, the approach has been to cull, as was the case in Parndana Conservation Park in 2000. However, the failures at several nests sites in 1999, and probably since then, have been perpetrated by a group of these cockatoos that has apparently been present in the Borda-De Mole area at the western end of the Island for decades (Dorothy Bates, pers. comm.). No birds have been culled from this flock of Sulphur-crested Cockatoos.

Grey Currawongs, *Strepera versicolor,* are also suspected as nest predators.

2.2.2 Nest hollow competition

Competition for nest hollows may prevent the cockatoos from starting nests or from successfully fledging young. The principal competitors are feral honeybees, Common Brushtail Possum, Yellow-tailed Black-Cockatoo, Little Corella and Galah. Feral bees are numerous on Kangaroo Island and occasionally invade hollows previously used by Glossy Black-Cockatoos.

The Yellow-tailed Black-Cockatoo (YtBC) nesting season extends from October to April, while the GBC nesting season extends from late January to November. As a result, YtBCs still occupy some nest hollows at the start of the Glossy Black-Cockatoo nesting season and, in some instances, Glossy Black-Cockatoos may be forced either to nest in a lower quality hollow or to nest later in the season when nest success is frequently lower. Numbers of Little Corellas, Galahs and possibly Yellow-tailed Black-Cockatoos on Kangaroo Island have increased in recent decades (See Part C, Section 2.2.1).

2.2.3 Nest hollow shortage

In some potential habitat areas of Kangaroo Island there appears to be a shortage of hollows suitable for nesting. Likely causes date back to the nineteenth and twentieth centuries and include

clearance for agriculture, commercial timber harvesting, the ring-barking of large eucalypts on pastoral properties and frequent burning. Competition from increasing numbers of nest hollow competitors has also created a shortage of available hollows.

GBCs used artificial hollows within months of their erection at Stokes Bay, Middle River and Western River. In 2003, the cockatoos nested successfully in artificial hollows at several additional sites (Pedler 2003a). Elsewhere on KI the cockatoos use only natural hollows and have not yet used the artificial hollows that have been provided. Artificial hollows require regular maintenance. (See Part D, Section 3.3).

2.3 Threat of habitat loss

Habitat destruction has been the primary cause of the Glossy Black-Cockatoo's decline. Grazing by domestic stock, native wildlife (wallabies, kangaroos and possums) and ferals (goats and deer) poses a threat to regenerating habitat on Kangaroo Island. On Fleurieu Peninsula, feral rabbits and hares pose additional threats to native seedling survival. Habitat is also threatened by developing residential areas and rural subdivisions.

Consideration of feeding and nesting habitat requirements must make provision for an increase in the population, and the unpredictable but inevitable short to medium term losses of habitat through wildfires. Insufficient habitat may prevent GBC re-establishment on Fleurieu Peninsula (Crowley *et al.* 1997).

2.3.1 Current habitat protection

Kangaroo Island

Around 30% of GBC feeding habitat and 45% of 'suitable nesting habitat' lies within DEH reserves, including some currently used nesting areas (Part B, Section 4.5). In the absence of livestock, there appears to be significant natural regeneration of habitat in cleared areas adjacent to remnant vegetation in some reserves.

Only around 9% of feeding habitat and 15% of 'suitable nesting habitat' (Part B, Sections 4.1 and 4.2) on private property is currently protected in Heritage Agreements (HAs). Significantly, more than 80 known nest sites are on private property, with less than 10% covered by HAs.

Around 420 ha of GBC habitat has been fenced from stock in projects funded through the Glossy Black Rescue Fund (GBRF). Set up by concerned members of the KI community in 1993, the GBRF is now managed by the GBC Recovery Team, although Nature Foundation SA continues to provide financial management. The GBRF has received funding from the Australian Government's Natural Heritage Trust (NHT), as well as significant private and corporate donations (See Acknowledgments).

Fleurieu Peninsula

The SA Glossy Black-Cockatoo has been listed among the species covered by the Mount Lofty Ranges Bird recovery Program, which developed from the Birds for Biodiversity project, a multi-species recovery project for the declining birds of the Mount Lofty Ranges (MLR). Participants in this partnership-based project, funded through the NHT, include the Adelaide and MLR Natural Resource Management Regional Board, DEH and the Conservation Council of South Australia. This umbrella group promotes community awareness, research and habitat conservation for declining bird species in the MLR.

2.3.2 Wildfire

Wildfire is a significant threat to Glossy Black-Cockatoo habitat, particularly on Kangaroo Island where large areas of contiguous habitat exist. There are numerous wildfire incidents each year on Kangaroo Island with the principal causes being escape from stubble burn off, ignition from farm machinery and lightning strike. Wildfire, however, has been less frequent in the last 30 years than

in the 1930s and 1950s when it appears that over half the remnant Drooping Sheoak was burnt (Overton 1994, 1997).

Wildfire impact on habitat depends on a number of factors including ground moisture at the time of the fire, fire intensity and post fire grazing pressure and climatic conditions. There is a need to consider and plan for fire in relation to both habitat re-instatement and conservation of existing habitat (see Part D, Section 3.5).

Drooping Sheoak stands appear to take at least 10 years to recover fruiting capacity after fire (pers. obs.). A series of large wildfires within a ten to fifteen year period could seriously limit food availability and GBC breeding success. While perhaps an unlikely event, a catastrophic wildfire could decimate cockatoo numbers, because of the long period between fire and habitat recovery. Population bottlenecks, with potential loss of genetic diversity and population vigour, have presumably occurred as a result of wildfires in the past. However, a recovering Glossy Black-Cockatoo population would have to face threats that did not occur in pre-European times, such as increased nest predation and competition for nest hollows, and habitat fragmentation (Burbidge and Raines 2003).

The other aspect that needs to be considered at this point is that periodic fire is required to regenerate GBC habitat. Over a period of many decades, fire generates feeding habitat with suitable cone crops and nesting habitat with suitable hollows. The 'right' fire regime to maintain suitable GBC habitat in the long term is not currently understood and further research is urgently needed in this area.

Fire and nesting habitat
Destruction of a regularly used GBC nesting area in a wildfire is a significant threat to the survival of a slow breeding species such as this, although observations of banded birds indicate that breeding pairs are capable of moving to new nesting areas and breeding successfully (GBC Recovery Program, unpubl. data).

Many large old hollow-bearing eucalypts are gutted during fires or collapse in the post fire period. The 'Riggs' fire of November 2002 resulted in the loss of two GBC nest trees in riparian habitat along the Northwest River, adjacent to Flinders Chase National Park. Other large Sugar Gums were felled by this fire, some of which may have otherwise developed suitable GBC nesting hollows in coming decades. On the other hand, as stated above, periodic fire also plays a role in the creation of suitable GBC nest hollows.

Fire and feeding habitat
Joseph (1982), Clout (1989) and others have noted the susceptibility of GBC feeding habitat to fire. Fire apparently caused the species' disappearance from King Island (Green and McGarvie 1971). After a major fire burnt out Drooping Sheoak feeding habitat on the west coast of Kangaroo Island in 1970, the birds did not return to the area for 8 years (C. Baxter pers. comm. in Pepper 1996). This area was burnt again in 1991 and the few chewings found indicate only brief visits by feeding birds since then. Burbidge and Raines (2003) recommended that a study be conducted on the fire response of *Allocasuarina verticillata* and the implications for the Glossy Black-Cockatoo.

2.3.3 Land clearance
Clearance for agriculture was the major cause of the GBC's decline on mainland South Australia. Legal broadacre land clearance ceased in 1985 with the South Australian Government's proclamation of the *Native Vegetation Management Act 1985*. Following recent amendments to the *Native Vegetation Act 1991,* prohibition of broad scale clearance has now received statutory recognition.

Under the *Development Act 1993,* district councils and the state Development Assessment Commission (DAC) seek advice from the Native Vegetation Council regarding applications for land subdivision where the development may impact on native vegetation. Currently, the Native Vegetation Council recommendation on subdivisions is provided on the basis of advice only. Decisions made by local council and the DAC may go against these recommendations.

Under 2003 amendments to the Native Vegetation Regulations, the Native Vegetation Council now has the capacity to provide direction on vegetation clearance prior to building within areas of native vegetation. Buildings must be positioned to minimise the clearance of native vegetation, with any clearance associated with development being conditional upon the achievement of a significant environmental benefit.

Under the *Native Vegetation Regulations 2003*, landowners wanting to build within areas of intact native vegetation must position any dwellings or structures in locations that will minimise the need for the clearance of native vegetation. Any clearance of native vegetation must be undertaken in accordance with a management plan approved by the Native Vegetation Council (NVC) that will minimise the impact of vegetation clearance and must, in the opinion of the Council, result in a significant environmental benefit. Where the environmental benefit cannot be achieved on the property, the landowner may apply to the NVC to make a payment into the Native Vegetation Fund. Those payments will be used by the NVC to achieve an environmental benefit elsewhere in the region.

There is good communication between Biodiversity Assessment Services, within the Department of Water, Land and Biodiversity Conservation (DWLBC), and the GBC Recovery Program regarding response to land development applications that potentially threaten GBC habitat. The GBC Recovery Team has also produced a statement in relation to land division and GBC habitat retention. This states that, in those cases where habitat clearance cannot be avoided, the only offsets acceptable to the SA Glossy Black Cockatoo Recovery Team are:

1. Where practicable the legal protection of all remaining GBC habitat on the land; AND
2. additional planting under legal protection that results in a net gain of habitat critical to the survival of the SA GBC.

This statement is reproduced in full in Part E.

While some on-going loss of habitat within towns and existing subdivisions is inevitable, good communication between the GBC Recovery Program, property owners and local council can help to minimise vegetation clearance. In 2001, following concerns about loss of critical habitat in developing residential areas, the GBC Recovery Team approached the Kangaroo Island Council. The result was a 'Note on File' placed on the list of conditions for development approval in the American River and Penneshaw areas, that emphasises the importance of retaining / restoring GBC feeding habitat. This note is also attached to property searches.

'Objectives' and 'Principles of Development Control' related to the conservation of habitat of threatened species have been included in the recently amended Kangaroo Island Council Development Plan (August, 2003). However, land zoned Residential, Deferred Urban, Country Living and Rural Living is still at risk. A major cause of concern is that increasing land values on Kangaroo Island will increase pressure on landholders to subdivide for financial gain. In the long term, this is likely to impact on the integrity and conservation of some regularly used GBC feeding and nesting areas.

The role of the Australian Government's *Environment Protection and Biodiversity Conservation Act 1999* in protecting GBC habitat has not yet been fully tested. In mid 2004, a land division in an area of remnant GBC habitat at American River was refused by KI Council, appealed in the State Environment, Resources and Development Court and referred under the EPBC Act. The

outcomes of both State and Australian Government processes in relation to this land division are still pending.

2.3.4 Habitat re-establishment on Kangaroo Island

Increasing the region's carrying capacity is important both to protect the current population from habitat loss in bush fires, and to allow the population to expand to a more secure size. Habitat re-establishment projects are attempting to redress earlier habitat loss as a result of clearance for agriculture and townships.

The extent of natural regeneration of both feeding and nesting habitat warrants some investigation (on both parks and private property), as this may provide critical future habitat. In particular, it would be useful to assess the impacts of wildfire and grazing by both wildlife and domestic stock on natural regeneration. This would make a good student project, for example.

Since 1994, around 100 ha of GBC habitat revegetation has taken place on Kangaroo Island, mostly carried out by individual landholders and funded through the Glossy Black Rescue Fund. Greening Australia (SA) has managed larger scale projects at Nepean Bay and Baudin Conservation Park at the eastern end of KI.

Revegetation has focussed on planting Drooping Sheoak at priority sites identified by Crowley *et al.* (1998b) (Part B, Section 4.1). Highest priority (priority A) areas were identified as areas within a 12 km radius of GBC nests with access to less than 400 ha of existing Drooping Sheoak. As new GBC nest sites have been established or become known to the program, the area classified as priority A has expanded considerably. Current strategies still take this priority system into account but suggest that all potential areas mapped as suitable for Drooping Sheoak re-instatement (Crowley *et al* 1998a) be considered for funding, with a focus on sites within a few kilometres of active GBC nests or known foraging areas.

Burbidge and Raines (2003) recommend that revegetation efforts should be directed towards the GBC 'flocks' that are likely to show the greatest increase in productivity if habitat is increased, and towards those that are exposed to the risk of significant habitat loss in wildfire. These authors also recommend that more attention be given to re-establishment of breeding habitat, although a long term perspective is obviously required. The most practical approach in the short to medium term is to plant Drooping Sheoak near existing mature (slow growing) Sugar Gums and South Australian Blue Gums.

There has also been increased focus in the last few years on more comprehensive habitat restoration, taking into account the suite of overstorey, understorey and groundcover species that formerly existed at the site.

2.3.5 Habitat re-establishment on Fleurieu Peninsula

Both Greening Australia (GA) and the GBRF have been involved in GBC habitat re-instatement on Fleurieu Peninsula in the last few years, centred on the Cape Jervis-Second Valley areas. Sites chosen generally fall in line with the recommendation of Crowley *et al.* (1998b) that revegetation efforts should aim to increase the area of feeding habitat between the potential GBC nesting area in Deep Creek Conservation Park and the closest landfall to Kangaroo Island.

Between 1998 and 2002, GA have managed a large scale project on around 50 ha of Coast Protection Board land at Fishery Beach, several kilometres east of Cape Jervis. School children and Green Corps groups have planted many thousands of trees, with a good survival rate.

In 2001-2002, around 10 ha of feeding habitat was planted in joint GA/GBRF projects on private property with tubestock showing better survival than direct seeding to date. The GBC Recovery Team have obtained sponsorship from Tarong Energy for 10 ha of GBC habitat re-instatement on private land near Cape Jervis. GA has been contracted to undertake this work in June 2004.

2.4 Inbreeding and loss of genetic diversity

The GBC may be in a genetic bottleneck, with an effective population size below that necessary to maintain genetic diversity. If the population remains small for several generations it may lose genetic diversity and an ability to adapt to changes in the environment, and will risk inbreeding depression and accompanying loss of health and fertility. There is a need for research regarding the genetic diversity of the population on Kangaroo Island.

If the SA GBC population is inbred, it may affect the birds' ability to adapt to predicted changes in climate over the next few decades. For example, a potentially drier climate might impact on the annual production of cones by Drooping Sheoak and reduce the available feeding habitat.

2.5 Nest robbing

Nest robbing for the pet trade is considered a threat to many endangered parrots. No individuals of this subspecies are currently known in captivity. While there is no evidence that nest robbing has affected the SA GBC, it is important to recognise this danger because of the relatively high public profile and accessibility of the GBC population on Kangaroo Island.

2.6 Loss of community involvement

Volunteers have played and will continue to play a vital role in the success of the GBC recovery program and their valuable contribution to date is here acknowledged by the GBC Recovery Team. To quote Burbidge and Raines (2003):

'Volunteer contribution has been essential for this project. Volunteers played a major role in starting the project and helping to find funds through the Glossy Black Rescue Fund. The annual census cannot obtain complete coverage without volunteers, they have played a major role in the revegetation program and they have assisted in locating cockatoo nests. This volunteer contribution clearly has a high monetary value in the GBC recovery program.'

A small group of fifteen to twenty local volunteers plays an important role, assisting with location and monitoring of active GBC nests, during the breeding season, contributing 150-200 hours annually. A larger group of fifty or so mainly local residents plays a vital role in the annual population census. Volunteer school groups from Kangaroo Island, Adelaide and Fleurieu Peninsula have assisted with large scale habitat re-establishment (over 1 ha) while landowners have contributed their time in generally smaller scale planting projects.

The involvement and support of the public has been and will continue to be crucial to the recovery effort. A large proportion of GBC habitat is privately owned, and the attitude and involvement of landowners will be important factors in determining the species' fate. It is vital to maintain media coverage, since future funding needs are dependant on the Glossy Black-Cockatoo having a high profile in the general community.

3. Areas under threat

The threatening processes described above occur throughout GBC habitat areas on Kangaroo Island. The threat of habitat loss, including impacts of wildfire, also extends to potential habitat areas on Fleurieu Peninsula (See map layers provided, Part B, Section 4.4.3).

PART D OBJECTIVES, PERFORMANCE CRITERIA AND ACTIONS

1. Recovery objectives

1.1 Long term objectives

The recent GBC Recovery Program Review (Burbidge and Raines 2003) emphasised the need for a long term perspective when managing a long-lived, slow-breeding species, such as the Glossy Black-Cockatoo.

As a consequence, three long term objectives have been identified for recovery of the SA Glossy Black-Cockatoo:

(1) To ensure that a viable breeding population of the Glossy Black-Cockatoo persists in South Australia;

(2) To shift the status of the SA Glossy Black-Cockatoo from Endangered to Vulnerable within 25 years (ie. by 2030);

(3) To expand the current distribution of the SA Glossy Black-Cockatoo to include its former range on Fleurieu Peninsula.

Performance Criteria for long term objectives

(1) Sustained breeding success of at least 40 fledglings per year or a number sufficient to replace annual mortality, whichever is the greater;

(2) An increase in the Glossy Black-Cockatoo population in South Australia to at least 400 birds, including >125 mature females;

(3) Regular sightings of Glossy Black-Cockatoos using nesting, roosting or feeding habitat recorded on Fleurieu Peninsula.

1.2 Specific objectives for the five year period of this plan

Specific objectives and performance criteria during the five year period, from July 2004 to June 2009, covered by this Recovery Plan are outlined in Table 3.

Table 3. Objectives, actions and performance criteria for the five year Recovery Plan.

Specific Objectives for the five year Recovery Plan	Actions and Performance Criteria
1. To maintain GBC population growth.	***All actions*** An increase in the GBC census minimum to at least 300 birds, including at least 80 mature females. A minimum of 30 fledglings recorded each year.
2. To promote and facilitate community interest, understanding and participation.	***Action 2a: Facilitate public awareness and community ownership of the GBC Recovery Program*** a) continuing interest in the program, in the local KI and southern Fleurieu communities and amongst the wider Australian public; ***Action 2b: Establish, coordinate and maintain a group of volunteers to support the recovery process*** b) at least 40 active volunteers, contributing minimum 120 hours during annual census and minimum 160 hours in nest monitoring annually.
3. To conserve GBC nest sites on Kangaroo Island: a) to protect and maintain known nest sites; b) to minimise impact of feral bees at nests; c) to minimise interference from other cockatoo species.	***Action 3a: Protect all known nest sites from possum access and carry out annual nest maintenance*** a) >95% of known nest sites (currently around 180, including 85 artificial hollows) protected from possum access and annual maintenance carried out on at least 50% of artificial hollows; ***Action 3b: Protect a proportion of natural nests and at least 50% of artificial nests from bee invasion as part of annual nest maintenance*** b) maximum 2% of known nest sites invaded annually by feral bees; ***Action 3c: Minimise interference from other bird species at nests*** c) less than 5% of known nest attempts impacted by other species.
4. To monitor GBC nesting and maintain nesting success.	***Action 4: Monitor nesting and locate new nests*** Minimum of 45 active nests located each year; nesting success monitored and an annual report produced.

5. To conserve GBC habitat on Kangaroo Island: a) protection of existing feeding and nesting habitat; b) reinstatement of feeding and nesting habitat at strategic locations; c) fire protection measures to reduce the risk of loss of habitat critical to GBC survival.	***Action 5a: Protect existing feeding and nesting habitat*** a) an additional 100ha of GBC habitat on Kangaroo Island protected through Heritage Agreements or Land Management Agreements; ***Action 5b: Re-establish habitat on Kangaroo Island*** b) an additional 30ha of habitat re-established at strategic locations; ***Action 5c: Wildfire protection*** c) GBC habitat protection measures included in fire management plans: maximum 5% of feeding habitat area and 5% of nest sites burnt over five year period.
6. To conserve GBC habitat within the former range of the Glossy Black-Cockatoo on Fleurieu Peninsula: a) protection of existing feeding and nesting habitat; b) strategic reinstatement of feeding and nesting habitat; c) fire protection measures to reduce the risk of loss of habitat.	***Action 6a: Protect existing feeding and nesting habitat*** a) an additional 10ha of habitat on Fleurieu Peninsula protected through Heritage Agreements or Land Management Agreements; ***Action 6b: Re-establish habitat on Fleurieu Peninsula*** b) an additional 20ha of feeding and nesting habitat re-established at strategic locations on Fleurieu Peninsula; ***Action 6c: Wildfire protection*** c) GBC habitat protection measures included in fire management plans and pre-fire season operations.
7. To monitor GBC population growth, demography and the movements of individual birds.	***Action 7: Survey and monitor the population*** a) annual population census conducted and report produced; b) regular monitoring of marked birds and annual report produced on survivorship and movements.

2. Evaluation of recovery success - The recovery team

The Glossy Black-Cockatoo Recovery Team will continue to evaluate recovery success, meeting twice a year. If funding is available, it would be useful to undertake another Five year Review of the GBC Recovery Program in 2008.

The Recovery Team will consist of one representative (except where indicated) from each of the following organisations:

- Department for Environment and Heritage:
  - Wildlife Management Officer, Kangaroo Island (Chair)
  - Conservation Programs Manager, Kangaroo Island
  - Senior Ecologist, Threatened Species and Ecological Communities, Adelaide
  - Ranger, Operations Management Unit, Kangaroo Island

- Threatened Species Network, SA Coordinator

- University of Adelaide, Department of Environmental Biology (specialist ornithologist)

- Kangaroo Island Natural Resource Management Regional Board

- Kangaroo Island volunteers (2 representatives, not fixed individuals)

- Others, including DEH project staff, will attend as expert advisers.

Kangaroo Island Council, Greening Australia and Mount Lofty Ranges Bird Recovery project to be sent minutes of Recovery Team meetings.

3. Recovery actions

3.1 ALL ACTIONS: MAINTAIN GBC POPULATION GROWTH

Addressing objective 1

Aim

To increase the GBC population on Kangaroo Island to a minimum of 300 individuals, including at least 80 mature females, in relation to the long term objective of a population of 400 birds (125 mature females).

3.2 ACTION 2: PROMOTE AND FACILITATE COMMUNITY INTEREST, UNDERSTANDING AND PARTICIPATION

Action 2a: Facilitate public awareness and community ownership of the GBC recovery program

Addressing objective 2a

Aims

To maintain community awareness, interest in and ownership of the GBC Recovery Program; to encourage beneficial land management practices to conserve GBC habitat; to ensure that visitation of sites frequented by GBCs does not adversely impact on feeding and breeding activity.

Burbidge and Raines (2003) highlight the importance of communicating the project to the wider South Australian and Australian community.

Methods

- It is important to maintain a high profile and good communication with major stakeholders and sponsors, in relation to key aspects and successes of the project. These include the KI Natural Resources Management Regional Board (KINRMB), KI Council, Threatened Species Network (SA), Birds Australia, Nature Foundation SA and State and Australian government agencies, as well as potential new sponsors;

- Production of the twice yearly newsletter, *Chewings,* that is mailed out to active participants and others with an interest in the recovery program;

- Presentations to schools, clubs and organisations on Kangaroo Island and the mainland, as opportunities present themselves;

- Occasional articles in the popular press targeting the wider South Australian and Australian communities, in addition to articles in the Kangaroo Island and Fleurieu press;

- Regular articles in relevant environmental and ornithological newsletters, including *Wingspan, Eclectus, The Web, Volunteer* and Kangaroo Island and mainland landcare newsletters;

- Involvement in TV and film projects, as opportunities present themselves;

- Information packages provided to students and other interested parties on request;

- Maintain links with other groups involved with the recovery of the Glossy Black-Cockatoo, including those in the eastern states, and with other threatened species;

- While it is important to maintain public interest in the cockatoos, visitor impacts may need to be controlled at some sites. In April 2003, conditions were place on Commercial Tour Operator licenses regarding access to Lathami Conservation Park, including the necessity for guide inductions by DEH staff.

- There may be a need, from time to time, to carry out an assessment as to whether promotional activities are successful and on target.

Action 2b: Establish and coordinate a group of volunteers with the skills necessary to support the recovery process

Addressing objectives 2b, 4 and 7a

Aims

To establish and maintain a group of volunteers trained to assist with location and monitoring of active nests during the breeding season, to assist with the annual population census and habitat search and to undertake other tasks that benefit the GBC recovery program.

Methods

- Volunteer involvement in nest location, the annual census and habitat conservation is covered under Actions 1, 2, 5 and 6;

- Promote volunteer involvement in other aspects of the recovery program, such as publicity and the collection of survivorship data;

- Ensure good feedback to volunteers regarding the GBC recovery program and regular acknowledgment of their contribution, both personally and in publicity material;

- Long term volunteer input can only be maintained and remain productive with the support of paid staff.

3.3 ACTION 3: CONSERVE GBC NEST SITES ON KANGAROO ISLAND

Action 3a: Protect all known nest sites from possum access and carry out annual nest maintenance

Action 3b: Protect a proportion of natural and artificial hollows from feral bee invasion as part of annual nest maintenance

Addressing objectives 3a and 3b

Aims

To maximise success of natural and artificial nests by ensuring that they are in a condition suitable for nesting at the start of each breeding season.

Methods

- There are currently 104 recorded nest trees with natural hollows and over 80 artificial hollows have been erected. Natural (N) nest hollows and artificial (A) hollows require regular maintenance to:

  - ensure that possum access is restricted (N, A);

- deter feral bees from invading hollows and to treat feral hives in and near nests (N, A);
- protect hollows from flooding (N);
- ensure that wooden chewing blocks and internal climbing blocks/ladders are intact (A);

- In 2003, a new approach was taken to nest maintenance and only half the artificial hollows (randomly chosen) were treated for bees. Two untreated hollows in the eastern part of KI were invaded by bees. In future it is proposed to treat artificial hollows in areas identified as more prone to bee invasion every year and the remainder every two to three years, also taking into account that some years may be worse for bee swarms than others and may necessitate greater effort.

- Annual nest maintenance is to be carried out by trained casual employees, under the supervision of project staff. Nest maintenance is to be carried out within an experimental framework, to assess effectiveness of actions:

  - iron collars to exclude possums are to be attached around natural nest trees and all trees containing artificial hollows; overlapping canopies to be pruned where possible;

  - new nest sites to be protected from possum access with tree collars and, where necessary, canopy pruning, as soon as possible after they are located;

  - invertebrate pest strip to be inserted each year (late winter to spring) in natural nest hollows that are known to be prone to bee invasion and in a proportion of artificial hollows;

  - feral bee hives in nest trees or neighbouring trees to be treated where possible and honeycomb removed;

  - natural hollows that are prone to flooding to be drilled out;

  - chewing blocks and/or climbing ladders to be checked and maintained; general condition of artificial hollows, including attachments to tree to be checked regularly;

  - ensure that tree climbing skills of project and casual staff are maintained to the required level, through annual training sessions with the Kingscote State Emergency Service (SES) and biennial training conducted by a qualified SES Vertical Rescue Instructor.

- Annual record to be maintained of nest hollow status and management and summary nest maintenance report produced.

- GBC Recovery Team to continue liaison with the Kangaroo Island Beekeepers Association to minimise impacts of feral bees on GBC nest sites. This may include monitoring of feral hives and placement of trap hives in strategic areas.

Action 3c: Minimise interference from other bird species at nests

Addressing objective 3c

Aims

This action aims to minimise the level of competition for nests and attacks on eggs and young by Little Corellas, Galahs and other avian species.

Methods

- Targeted culling of Little Corellas, Galahs and Sulphur-crested Cockatoos, where the latter

are believed to be cage escapees, at GBC nest sites, to be undertaken by project and casual staff, with the required expertise, licences, permissions and ethics approval;

- Annual report of pest bird management;
- Continued DEH involvement in the Kangaroo Island Pest Bird Management Task Group that aims to reduce the Little Corella population on Kangaroo Island;
- Encourage research projects that aim to study the population and breeding dynamics of Yellow-tailed Black-Cockatoos, Galahs or Little Corellas on Kangaroo Island and the impact of these species on GBC nesting.

3.4 ACTION 4: MONITOR NESTING AND LOCATE NEW NESTS

Addressing objectives 2b, 4

Aims

To locate and monitor active nests, in both natural and artificial hollows, during each breeding season, with volunteer assistance.

Methods

- All known nest areas are to be visited several times during the breeding season, by project staff and volunteers, to check for activity; additional nests are to be sought in likely sites;
- Actively promote volunteer involvement in this action; coordinate volunteer visits to remote nesting areas and also encourage volunteers to monitor nests in their district, where this is feasible;
- Locate new nests: each year around 15% of nesting cockatoos choose new natural nest sites that need to be protected from possum predation; new nests distant from previously known nest sites are usually located through community informants;
- New nest locations to be added to the ACCESS database and GIS nest site layer, both of which have restricted access;
- Nestlings to be banded in as many nests as feasible, to provide a marked cohort for on-going survivorship data;
- Nest event and nestling banding and measurement data to be stored in the GBC ACCESS database, updated at least annually;
- Project staff to report annually on breeding season, outlining nest attempts in natural and artificial hollows, reasons for nest failure if known and any maintenance works carried out;
- Information on GBC nesting areas to be included in DEH and Kangaroo Island Council fire management plans, by no later than August each year, and to be readily available to the Incident Control Team in the event of a wildfire.

3.5 ACTION 5: CONSERVE GBC HABITAT ON KANGAROO ISLAND

Action 5a: Protect existing feeding and nesting habitat

Addressing objective 5a

Aims

To prevent loss of Glossy Black-Cockatoo habitat on Kangaroo Island by protecting it from grazing, degradation and land clearance.

Methods

- Identify owners of private land that contains critical GBC feeding habitat and nesting areas and undertake an active extension program to encourage landowners to take out Heritage Agreements; also target new landowners when properties change hands;

- Encourage landowners to protect GBC habitat, by providing financial incentives through the Glossy Black Rescue Fund;

- Ongoing links with facilitators of the KINRMB On Ground Works program to maximise extension reach of the GBC Recovery Program and to promote multi-benefit land management outcomes;

- Ongoing liaison and consultation with KI Council planning officers to reinforce the conservation importance of GBC habitat on Council land and on private land under planning control;

- Work with DWLBC Biodiversity Assessments staff and the Native Vegetation Council to prevent clearance of GBC habitat in future residential and rural land subdivisions, to minimise clearance in existing subdivisions and to seek opportunities to have GBC habitat re-instated (see GBC Recovery team statement in part E);

- Report annually on areas of GBC habitat cleared and areas burnt in wildfire and prescribed burns;

- Critical areas for GBC conservation to be identified (mapped) and prioritised for acquisition and inclusion in the DEH reserves system;

- Encourage student research project to better define and map critical GBC nesting habitat, using GIS, based on a habitat suitability model linked to nesting success, based on tree and hollow parameters and other factors such as post fire age, vegetation condition and proximity to feeding habitat;

- Encourage student research to better define and map critical GBC feeding habitat, using GIS, based on a habitat suitability model that takes into account tree, cone and seed parameters that characterise GBC feeding trees, GBC use of habitat post-fire and proximity to nest sites;

- Encourage research to assess and map the extent of natural regeneration of feeding and nesting habitat in a range of different grazing (domestic stock, kangaroos, wallabies, goats etc.) and post fire scenarios.

Action 5b: Re-establish habitat

Addressing objective 5b

Aims

To increase the carrying capacity of strategic areas of Kangaroo Island for GBC flocks by

creating new foraging and nesting habitat.

Methods

- Continue to promote community awareness of the importance of habitat re-establishment for the GBC;

- Continue to support, both logistically and financially, and to record voluntary landowner efforts to re-establish GBC habitat, in conjunction with the GBRF, KINRMB and Trees For Life;

- Maintain links with facilitators of the KINRMB On Ground Works program to maximise extension reach of the GBC Recovery Program and to promote multi-benefit land management outcomes;

- Provide guidelines for GBC habitat restoration projects, based on available research defining critical parameters for feeding and nesting habitat;

- Maintain records, including GIS, of GBC use of revegetation sites;

- Aim to restore areas of breeding habitat, strategically, close to good quality feeding habitat, preferably through management of existing habitat to encourage natural regeneration, and identify these area on GIS;

- Aim to restore feeding habitat in areas identified as having less than 400 ha of Drooping Sheoak within 12 km of nest sites, eg, sites in the vicinity of American River township and in parts of the Cygnet River, Northeast River and De Mole River catchments (Crowley *et al*. 1998b).

- Continue to support and document habitat re-instatement projects on DEH reserves, such as Lathami Conservation Park and Baudin Conservation Park;

- Continue to collaborate with GA and the Green Corps to facilitate larger scale revegetation projects;

- Encourage all parties undertaking revegetation projects to include the proportion and range of species and density and heterogeneity of plants that exist in nearby habitat remnants in good condition;
- Encourage landowners to collect their own seed on site, or alternatively to purchase it from the Kangaroo Island Community Seed Bank; KI growers of Drooping Sheoak to include at least 10% of seed from known GBC feeding trees, to allow for the possibility of genetic inheritance of the characteristics that distinguish favoured feeding trees;

- Continue to assess GBC habitat planting regimes to provide advice for current and future projects, especially in relation to arrangement and densities of plantings.

Action 5c: Wildfire protection

Addressing objective 5c

Aims

To reduce the risk of losing habitat critical to the survival of the Glossy Black-Cockatoo on Kangaroo Island. An important goal is to avoid extensive areas of habitat being burnt in single or consecutive wildfires.

Methods

- Annual winter fire planning meeting with relevant DEH / CFS staff on Kangaroo Island to discuss pre-fire season operations to reduce the hazard to critical GBC habitat, both on and off reserve areas, and the procedure to be followed during wildfire events;
- Availability of maps showing critical GBC feeding and nesting habitat, in GIS format and hard copy, to members of the Incident Control Team in a wildfire event; GBC project staff to provide on-site advice and assist with interpretation of maps as required;
- Ongoing input into community bushfire prevention plans, in liaison with the KI Council Bushfire Prevention Officer;
- Ongoing input into fire management plans for areas in the DEH protected estate;
- Liaison with DEH Bush Management Adviser regarding fire management in GBC habitat areas covered by Heritage Agreements;
- Encourage research to investigate the fire regimes required to maintain optimal GBC feeding and nesting habitat.
- Encourage student research to assess the fire response of *Allocasuarina verticillata* and GBC use of this feeding habitat post fire, including both field and modelling components.

3.6 ACTION 6: CONSERVE GBC HABITAT ON FLEURIEU PENINSULA

Action 6a: Protect existing feeding and nesting habitat on Fleurieu Peninsula

Addressing objective 6a

Aims

To prevent further loss of potential GBC habitat on Fleurieu Peninsula by protecting it from grazing and land clearance, thus providing additional security for the future survival of the Glossy Black-Cockatoo in South Australia.

Methods

- Continue to promote community awareness of the importance of protection of all remnant vegetation that is potential GBC habitat;
- Work cooperatively with the MLR Bird recovery Program to conserve potential GBC habitat;
- Continue to liaise with the DEH Bush Management Adviser, Primary Industries SA staff and the Local Action Planning officer for southern Fleurieu regarding habitat conservation;
- Support research to better define and map potential GBC feeding and nesting habitat on

Fleurieu Peninsula.

Action 6b: Re-establish habitat on Fleurieu Peninsula

Addressing objective 6b

Aims

To increase the area of feeding habitat for GBCs on Fleurieu Peninsula, at strategic locations.

Methods

- Continue to promote community awareness on Fleurieu Peninsula of the importance of habitat re-establishment for the GBC;
- Work cooperatively with the MLR Bird Recovery Program and GA to facilitate larger scale habitat restoration;
- Continue to support, both logistically and financially, voluntary landowner efforts to re-establish GBC habitat, in conjunction with the GBRF, MLR Natural Resources Management Regional Board, Local Action Planning and Trees For Life;
- Encourage all parties undertaking revegetation projects to include the proportion and range of species, and density and heterogeneity of plants that exist in nearby habitat remnants in good condition;
- Continue to assess GBC habitat planting regimes to provide advice for current and future projects, especially in relation to arrangement and densities of plantings.

Action 6c: Wildfire protection

Addressing objective 6c

Aims

To reduce the risk of losing any remaining GBC habitat on Fleurieu Peninsula.

Methods

- Biennial fire planning meeting with relevant DEH staff to discuss pre-fire season operations to reduce the hazard to critical GBC habitat and the procedure to be followed during wildfire events;
- Availability of GIS maps showing potential GBC feeding and nesting habitat, in digital format, to members of the Incident Control Team in a wildfire event; GBC project staff to provide on-site advice and assist with interpretation of maps as required;
- Input into fire management plans for relevant areas in the DEH protected area estate;
- Liaison with DEH BMA regarding fire management in GBC habitat areas covered by Heritage Agreements.

3.7 ACTION 7: SURVEY AND MONITOR THE POPULATION

Addressing objectives 1, 2b and 7

Aims

To survey Kangaroo Island for Glossy Black-Cockatoos on a regular basis to obtain accurate current information on population size, flock structure, recruitment, and distribution. Reported GBC sightings on Fleurieu Peninsula to be thoroughly investigated.

Methods

- Annual population census of post-breeding flocks on Kangaroo Island to be conducted in early to mid October to assess flock size and composition and to determine levels of recruitment; the same localities to be surveyed each year so that the results are comparable;

- Each year some known birds are missed in the annual census, and adjustments are made to the total, based on the considered assessment of project staff that some groups of birds were not located (for example, Pedler 2003b). These adjusted estimates of bird numbers should continue to be provided, based on the knowledge and expertise of experienced project staff. The GBC Recovery Team recognises that great care need to be taken with such an approach, given the low overall numbers of birds and slow rate of population growth. Minimum bird numbers (raw count data) are to be provided and reasons for each adjustment to the count are to be documented.

- Volunteer participation to be actively canvassed and prompt feedback provided to those who take part in the census;

- Volunteer involvement is twofold, with participation of trained volunteers in counting and analysis of GBC flocks, and extensive involvement of a broader group of volunteers in habitat searches throughout Kangaroo Island;

- Project staff to report annually to the GBC Recovery Team on census results, including GBC population size, age and sex structure, volunteer participation and staff effort;

- Project staff to continue to collect and report on survivorship data, through reading of leg band numbers; report to include the effort involved in this action; volunteer involvement in this action to be encouraged and regular opportunities provided;

- Band observation data to be stored in the GBC ACCESS database and updated at least annually; census results to be recorded in Excel spreadsheet; report also on the effort involved in these actions;

- Reported sightings of GBCs on Fleurieu Peninsula to be followed up by project staff, with phone calls and field inspections; investigation results to be recorded in ACCESS database and reported to GBC Recovery Team.

PART E THREAT MANAGEMENT PRACTICES

As a general guide any management practice that is likely to impact on critical GBC habitat on Kangaroo Island or Fleurieu Peninsula should be considered carefully. Activities assisting or promoting the impact of any of the threatening processes identified within this plan should be avoided where possible.

Table 4 provides examples of activities and management practices that may limit the success of this recovery program. This list is not exhaustive and should be treated as a guide only. Management practices and actions benefiting the recovery of the GBC are described in full in PART D, Section 3 of this plan.

Table 4 highlights the importance of a cooperative approach to biodiversity management. Effort is required by the GBC Recovery team and the facilitators of other natural resource management programs on KI and Fleurieu Peninsula to maximise the extension reach of the project and wherever possible to promote multi-benefit land management outcomes. It is important that local government and private and corporate landholders are made aware of management practices that are beneficial to GBC recovery.

Increasing subdivision of rural and residential land is seen as a significant threat to GBC recovery. The GBC Recovery Team has produced a statement in relation to land division and GBC habitat retention:

'Many areas of Kangaroo Island, that are subject to current or potential subdivision, support feeding and nesting habitat that is critical to the survival of the South Australian Glossy Black-Cockatoo (GBC). Vegetation clearance associated with inappropriate rural and residential subdivision is a significant threat to the viability of the SA GBC population.

Approval of further subdivisions should be avoided where such development may result in the loss of GBC habitat.

In the case of existing subdivisions, the clearance of GBC habitat for houses and associated infrastructure can only be undertaken within the framework of the *Native Vegetation Act 1991*, exemptions contained in the *Native Vegetation Regulations 2003*, and the provisions of the *Environment Protection and Biodiversity Conservation Act 1999.* The Native Vegetation Act and Regulations require landowners to ensure that any development is located so as to avoid or minimise the loss of native vegetation. Where clearance cannot be avoided, that action must be undertaken in accordance with an approved management plan, which may involve a compromise or offset in accordance with the principles of the Native Vegetation Act and Regulations. In such cases, the following offsets are the only such measures acceptable to the SA Glossy Black Cockatoo Recovery Team, to mitigate adverse impacts on GBC populations:

1. where practicable the legal protection of all remaining GBC habitat on the land; AND
2. additional planting under legal protection that results in a net gain of habitat critical to the survival of the SA GBC.

All remnant Drooping Sheoak, (*Allocasuarina verticillata*) on Kangaroo Island is defined in the GBC Recovery Plan as critical habitat.

Large eucalypts bearing suitable hollows for nesting are also a critical component of GBC habitat. Most suitable nesting trees are over a hundred years old, and may be subject to natural attrition as well as incremental clearance. It is therefore important to protect both mature and near-mature gums of appropriate species (eg. Sugar Gum *Eucalyptus cladocalyx* and SA Blue Gum *E.leucoxylon*), to allow for the ongoing formation of suitable nest hollows.

Any planting of eucalypt seedlings of these key species as potential conservation off-sets against clearance of mature or near-mature trees will be unlikely to provide significant conservation benefits for GBCs for well over 100 years.

American River is recognised as an area where a shortage of available habitat may limit the future recovery of the local GBC population. This shortage will be exacerbated by the significant cumulative amounts of habitat that are likely to be lost in the near future due to clearance for house sites and associated infrastructure in existing subdivisions. In addition to feeding habitat, hollow-bearing trees are of particular importance in this area. GBCs on eastern Kangaroo Island have not successfully bred in artificial hollows. The protection of existing and potential feeding and nesting habitat is therefore of critical importance in the American River area.'

Table 4. Threat management practices that may limit Glossy Black-Cockatoo recovery.

Threat or impediment to recovery	Management activities that may contribute to threat
Lack of resources	Insufficient funding allocation
Poor coordination of recovery process	Failure to maintain project staff with sufficient expertise to implement the recovery program
Lack of community involvement	Insufficient effort to promote and provide opportunities for volunteer involvement
Pest species	Failure to identify or manage pest species that impact on GBC nesting success and survival
Loss of critical habitat in wildfire	Insufficient effort to brief relevant authorities (CFS, DEH, KINRMB) on the location of critical GBC habitat and the importance of protection from wildfire
Degraded critical nesting habitat on Kangaroo Island	Failure to promote importance of GBC nesting areas to landowners and all levels of government Failure to initiate and support research to identify additional areas of critical nesting habitat
Degraded critical feeding habitat on Kangaroo island	Failure to promote importance of GBC feeding habitat to landowners and all levels of government
Loss of critical habitat through clearance for development / subdivision	Failure to promote location and importance of GBC habitat to landowners and all levels of government
Grazing	Grazing of livestock in critical and potential habitat, significantly impacting on natural regeneration
Degraded critical and potential habitat on Fleurieu Peninsula	Failure to initiate and support research to identify critical and potential habitat
Phytophthora	Activity inadvertently contributing to the transfer of soil material leading to the spread of Pc into GBC habitat areas
Lack of community awareness of the GBC Recovery Program	Insufficient effort to promote knowledge of and interest in the recovery program amongst the broader Australian community
Visitor impact	Failure to control impact of increasing visitor pressure on GBC population
Inadequate knowledge of threats	Failure to adequately monitor threatening processes
Inadequate knowledge of GBC abundance, recruitment and survivorship	Failure to maintain project staff with sufficient expertise to survey and monitor the population
Inadequate knowledge of ecology	Failure to develop a cooperative approach to research into GBC biology, ecology and habitat use

PART F: DURATION AND COSTS

1. Duration of project

This recovery plan outlines the Actions for the SA GBC Recovery Program for the next five years, commencing in July 2004. GBC recovery will be a long term process and there is every likelihood that the birds will still have threatened species status at the completion of this five year period. Based on the current rate of recovery, it would be a considerable achievement to reach the long term recovery plan goal, to shift the status of the SA GBC to Vulnerable by 2030.

It is therefore envisaged that the SA GBC Recovery Plan will require funding for some time to come, particularly if community involvement and adequate monitoring of the population are to continue. To quote Burbidge and Raines (2003):

'If the project is to survive into perpetuity, it also requires a sense of ownership in the community, the presence of persons who are personally invested in the project ... the nature and extent of the long term volunteer input required can only be expected to be maintained, and remain productive, if supported by paid staff.'

2. Five year budget

The budget is outlined in Table 5. The KI Natural Resources Management Regional Board (KINRMB) provides the regional delivery for the Australian Government's Natural Heritage Trust. The project 'Back from the Brink - Maintaining the Gains - SA Glossy Black-Cockatoo Recovery Program' is included in the KINRMB Investment Strategy (2003).

KINRMB has allocated $70,000 for this project in the 2005/06 funding bid, but these funds have not yet been received. The funding received from KINRMB in 2005/06 will be topped up with unspent corporate sponsorship and NHT funds from 2004/05. A funding application has also been submitted to the Threatened Species Network to cover some of the costs of the annual nest maintenance.

Annual submissions to KINRMB will be made to apply for funding for the ensuing years of the recovery plan period. The GBC Recovery Program will look to KINRMB to support its core business and to DEH for on-going contributions. Investment will be sought from corporate sponsors to support other recovery plan actions and research.

Table 5. Estimated costs for the GBC Recovery Program for 2005-2010

Actions	**Estimated costs**	**2005 / 2006**	**2006 / 2007**	**2007 / 2008**	**2008 / 2009**	**2009 / 2010**
1. Survey and monitor the population	Employment	14 500	14 500	14 5000	14 500	14 500
	Vehicle	1500	1500	1500	1500	1500
2. Nest monitoring / data maintenance	Employment	23 000	23 000	23 000	23 000	23 000
	Vehicle	4000	4000	4000	4000	4000
3. Nest maintenance	Employment	6000	6000	6000	6000	6000
	Vehicle	2000	2000	2000	2000	2000
	Equipment	500		500		500
4. Minimise impacts of pest birds	Employment	1500	1500	15000	1500	1500
	Vehicle	500	500	500	500	500
5. Conserve GBC habitat on KI	Employment	7000	7000	7000	7000	7000
	Vehicle	1000	1000	1000	1000	1000
6. Conserve GBC habitat on FP	Employment	2000	2000	2000	2000	2000
	Travel		500		500	
7. Publicity / education / promotion	Employment	8500	8500	8500	8500	8500
	Travel	1000	1000	1000	1000	1000
	Materials	500	500	500	500	500
8. Admin / reporting / funding management	Employment	9500	9500	9500	9500	9500
	Equip / mats	3000	3000	3000	3000	3000
	Travel	500	500	500	500	500
TOTALS		**86 500**	**86 500**	**86 500**	**86 500**	**86 500**

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LIST OF ABBREVIATIONS

ANZECC	Australian and New Zealand Environment and Conservation Council
BMA	DEH Bush Management Adviser
CFS	Country Fire Service
DEH	South Australian Department for Environment and Heritage
DWLBC	Department of Water, Land and Biodiversity Conservation
EA	Environment Australia
EPBC	Environmental Protection and Biodiversity Conservation
FP	Fleurieu Peninsula
GA	Greening Australia (SA)
GBC	Glossy Black-Cockatoo
GBRF	Glossy Black Rescue Fund
GIS	Geographic Information System
HA	Heritage Agreement
INRM	Integrated Natural Resource Management
KI	Kangaroo Island
KINRMB	Kangaroo Island Natural Resources Management Regional Board
MLR	Mount Lofty Ranges
NHT	Australian Government's Natural Heritage Trust
SA	South Australia
TSN	Threatened Species Network